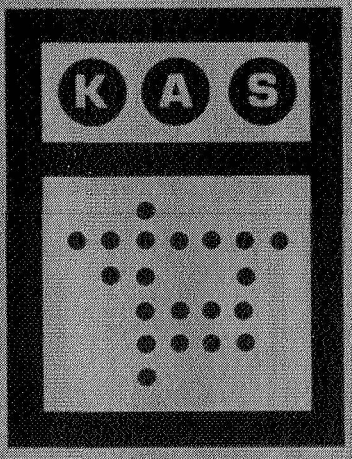
KASC
INFORMATION SERVICES

Final Report

EXPERIMENT IN DIRECT PROVISION OF HARD-COPY DOCUMENTATION OF AEROSPACE GENERATED TECHNOLOGY TO POTENTIAL USERS

University of Pittsburgh

July, 1970



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13. ABSTRACT

During a 12 month operational test the KASC provided document service to 73 clients receiving search services who requested a total of 2,891 document copies. In general, the type of search service providing a user with the greatest number of abstracts resulted in the greatest number of document requests; however, users receiving the least number of abstracts tended to request documents for a greater portion of the abstracts which they received. The KASC responded to 2,802 of the above requests during the 12 month period plus 218 requests received just prior to the beginning of the test. The KASC clientele requested approximately 4% to 5% of the documents announced by NASA in STAR during the year with 1.2 requests being submitted per document. Of the requests, 9% were rejected either because the document was not available to the KASC or the cost of the document exceeded that which the client was willing to pay. Of the documents, 80% were produceable by the KASC; however, 16% were obtainable at less cost to the client through the CFSTI. Three per cent of the documents were obtainable only through sources other than NASA or CFSTI. Documents produced locally were provided to KASC clients in one-fourth the time required to obtain them from other sources. Included in the narrative of the report is a description of the search services which the KASC offers to its clientele, the document service system, and the equipment used in production of documents. Clientele search service requirements, their document requirements, and the response of the KASC to these document requirements are presented in detail. Included with the conclusions drawn from the year's experiment are suggestions for additional study pertaining to local document production service for a clientele.

EXPERIMENT IN DIRECT PROVISION OF HARD-COPY DOCUMENTATION OF AEROSPACE GENERATED TECHNOLOGY TO POTENTIAL USERS

A Final Report on Contract NSR 39-011-078

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Pittsburgh, Pennsylvania 15213

TO : National Aeronautics and Space Administration
Washington, District of Columba 20546

DATE: July, 1970

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SUMMARY

An experiment was conducted in the decentralized reproduction and provision of hard copy of aerospace generated scientific and technical information contained in the NASA information resource to meet the requirements of the clientele of the Knowledge Availability Systems Center in its operation of a NASA regional dissemination center. During a 12 month operational test the KASC provided document service to 73 of the 93 organizations to whom search services were provided. Individual users within the 73 organizations comprised approximately 88% of the total users of the 93 organizations. A total of 2,891 document copies were requested with the average quantity per user being affected by the type of search services. he had received. In general, the type of service providing a user with the greatest quantity of abstracts resulted in the greatest number of document requests; however, users receiving the least number of abstracts tended to request document for a greater proportion of the abstracts which they received.

The KASC responded to 2,802 of the above requests during the 12 month period plus 218 requests received just prior to the beginning of the test. The KASC clientele requested approximately four to five per cent of the documents announced by NASA in STAR and the average number of requests per document was approximately 1.2. Nine per cent of the requests were rejected either because the document was not available to the KASC or the cost of the document exceeded that which the client was willing to pay. Eighty-eight per cent of the documents required were produceable

by the KASC; however, 16% were obtainable at less cost to the client through the CFSTI. Approximately 3% of the documents required were obtainable only through non-Federal government sources. Documents produced locally were provided to KASC clients in one-fourth the time required to obtain them from other sources.

Included in the narrative is a description of the search services which the KASC offers to its clientele, the document service system, and the equipment used in production of documents. Clientele search service requirements, their document requirements, and the response of the KASC to these document requirements are presented in detail. With the conclusion drawn from the year's experiment are suggestions for additional study pertaining to local document production service for a clientele.

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I. INTRODUCTION

The purpose of this report is to describe an experiment in the decentralized reproduction and provision of hard copy of aerospace generated scientific and technical information contained in the NASA information resource to meet the requirements of the clientele of the Knowledge Availability Systems Center (KASC) in the operation of a regional dissemination center (RDC). The experiment was conducted under National Aeronautics and Space Administration Contract No. NSR 39-011-078.

The report describes the search services offered by the RDC which affect the KASC clientele document requirements, the systematic procedures and equipment selected by the KASC to meet the clientele requirements, the results obtained for a year's operation of the system, and the conclusions reached.

II. THE REGIONAL DISSEMINATION CENTER SEARCH SERVICES

Overview

In the operation of a regional dissemination center (RDC) the Knowledge Availability Systems Center (KASC) offers to its clientele search services which bring to the attention of the KASC Clientele documents contained within the NASA information resource. Abstracts of the documents cited by the searches are identified for or are forwarded to clients subscribing to these services. A client may then select from among the abstracts those whose full document copy he would like to see and, using a KASC provided form, requisition the document through the KASC.

The KASC is capable of providing document copy from the NASA information resource in either microfiche or hard copy. In the operation of its regional dissemination activities, the NASA provides to KASC one microfiche copy of the documents which it announces through its bulletin STAR, except those whose distribution has been restricted by the publishing agency and those whose physical condition or the existence of a copyright prevent it from doing so. From this microfiche copy, the KASC prepares hard copy upon demand through the enlargement-exposure-development processes of a microfiche reader/printer or duplicates the microfiche through the exposure-development processes of diazo film duplicating equipment. When the microfiche copy is not available from NASA, the KASC will attempt to obtain the document in hard copy from another supplier.

It is probable that for the majority of the documents supplied by the KASC, the abstract copy or notice forwarded to the client constitutes

the initial notice of the document's existence. Because the abstracts are those which appear in the widely distributed NASA publication Scientific and Technical Aerospace Reports (STAR), it is possible for a client to discover a document's existence by his own perusal of that bulletin and to requisition the document through the KASC without the Center acting as an intermediary. Other bulletins, such as the U.S. Government Research and Development Reports (USGRDR), may also announce a NASA resource document by abstract publication which, again, may be subscribed to by a KASC client and act as the notification source. A fourth possibility is that a document obtained by a client may contain a reference to another document, not itself cited by a search or discovered through the client's own search efforts, which he then requisitions through the KASC. Of the four possible means of document notification, the first is responsible for the majority of the document copies supplied by the KAS Center to its clientele.

Search Types

The abstracts or their notices forwarded to a client by the KASC result from one or both of two types of searches which affect the frequency with which requests may be received for any one document. The two search types are retrospective and current awareness. The retrospective search (Retro) is a search of a document file, in whole or in part, previous to its most current additions. The KASC offers retro searches for the National Aeronautics and Space Administration file (unclassified) for the time period 1962 to present. The current awareness search (C/A) is a search

of only the most current additions to a document file performed at the periodic intervals for which a magnetic tape is issued containing the analytics of documents added to the file after the last tape was issued. The tapes provided to the KASC by NASA are issued monthly. A C/A search is seldom obtained by a client on an ad hoc basis; the client ordinarily contracts for a consecutive series of C/A searches for a specified period of time, usually 12 months. Following a search of the most current tape for C/A search service purposes, the data on the tape is appended to the retro tapes, consisting of data received from earlier tapes, so that the retro file continuously grows.

Obviously, a client's profile, i.e. his subject area of interest, may be searched retrospectively, on a current awareness basis, or both. His purpose for requesting the retro is not quite the same as for the C/A. A retro search generally exposes the client to a much larger number of documents than does a year's C/A service. However, he stands a much greater chance of having already been aware of many of the documents cited by a retro search than those cited by a C/A search because of the time lapse since their initial announcement. Furthermore, the usefulness of the documents cited by a retro may have been impaired by their age. A result is that the average client requests full copy of fewer documents cited by a retro search than of those cited by C/A service. Given a clientele which submits a greater number of profiles requiring C/A service than retro service, the demands for document copies will concentrate around those most recently added to the information resource.

Service Types

In addition to the two types of searches which the KASC offers to its clientele, there are four variations of service which are offered affecting the search output received by the client. The types of service combine with the search types to provide a KASC client with service options distinguished by the search scope (retro, C/A or retro + C/A) and the search output. Two aspects of the search output define the four service types, the physical and the intellectual, which are apparent in the following discussion of the four types.

Subscribers to Type I Service receive only a computer printout listing those accessioned items in the file whose index terms match the search strategy prepared for the subscriber's profile. Neither bibliographic citations nor abstracts are provided, nor are the search results reviewed by subject specialists. Subscribers must arrange for their own access to the appropriate abstract journals in order to identify and review abstracts of the documents in the file whose accession numbers appear on the computer printout.

Subscribers to Type II Service receive the complete bibliographic citation of all documents identified on the computer printout. In addition, an abstract of the document is provided as well. As in the case of Type I service, subject specialist talents are used only in preparation of the search strategy. All output, including "noise," is submitted to the client. No review of search results is performed by subject specialists.

Subscribers to Type III Service receive the complete bibliographic citation of all documents identified on the computer printout, plus the abstract. He receives both relevant and non-relevant items; however, those citations deemed relevant to the client's profile as determined by a subject specialist have been highlighted and separated from the remainder of the citations for the convenience of the clinet.

Subscribers to Type IV Service receive file output reflecting the general interest of a number of users. It is a current awareness service only. The subject specialist not only prepares the search strategy but also weeds "noise" from the output so that the user group receives the complete bibliographic citation and abstract of only those citations deemed relevant to the profile's subject.

It can be expected that a recipient of Type I service would request far fewer documents than subscribers of other service types by virtue of the simple fact that he must exert more energy to gain some idea of a document's content. Indeed, the extra energy requirements for this service are so great that during the three years in which it has been offered only three profiles required the service. As a result, it is eliminated from a consideration of the effect of service types upon the full document requests submitted by the KASC's clients.

Some distinction can be made between Type II and Type III services on the basis of their effect on document requests. Type II and Type III subscribers both receive abstracts of all documents cited by a

search, whether or not those of direct interest have been separated from the remaining abstracts cited. Inasmuch as the talents of a subject specialist have been equally applied to each service type for the initial development of a strategy, the products of the two service types received by their respective subscribers differ only in the sequential arrangement of the abstracts within the package. It appears that the Type II subscriber is almost as adept at discovering the abstract of a desirable document within his search package as the Type III subscriber who has had the additional assistance of a subject specialist.

Document requests received from Type IV subscribers greatly exceed those of Types II and III subscribers on a per profile basis. This phenomenon may be accounted for in part by the bias of the small numbers of Type IV profiles as compared with the other service types. It is most certainly accounted for by the small number of subscribers to each KASC Type IV profile which has never exceeded more than two subscribers per profile. These user groups of one or two subscribers tempt the subject specialist responsible for strategy development and output review to tailor the Type IV profile to the custom requirements of the one or two subscribers. Under these circumstances, the Type IV profile becomes a Type III profile of broad interest, and the Type IV profiles as a group become a highly biased subset of the Type III profiles. This bias is naturally reflected in the document request received from Type IV subscribers.

III. THE DOCUMENT SERVICE SYSTEM

Submission of Document Requests

KASC clients submit requests for the full copy of a document by letter, by telephone, and using the KASC document order form (Figure 3-1) copies of which accompany search output transmitted to clients. Multiple document requests submitted by a client cannot be filled simultaneously. The KASC cannot stock documents for off-the-shelf distribution. Space and personnel requirements would be excessive. The client's document copy must either be obtained from another organization or be reproduced for him from a copy held by the KASC. It is quite probable that for an order of two documents, one would have to be obtained from another source and the other would merely require duplication of a copy already in house. The KASC reproduced document would be available for mailing long before the one obtained from an outside source. To require that it wait upon the second document before mailing it to the client is a disservice to the client and an added cost in storage to the KASC. Each document requested by a client, then, is treated as a unit. The KASC document order form was designed for this purpose and, when requests are received by letter or telephone, the requests are transcribed onto document order forms.

The essential information required by the document order form before processing can begin is the medium (hard copy or microfiche) requested, the NASA accession or publishing agency's report number of the document, a numeric identification of the requesting client's organization, and, of course, an authorizing signature.

Packing slip portion

Mailing label portion

1. MEDIUM REQUESTED (✓)
☑ HARD COPY ☐ MICRO-FICHE

2. ACCESSION OR REPORT NO.
N67-19936

3. PROFILE NO.
11245

4. COMPUTER TAPE(S)
4-70

5. COMPANY NO.
1971

6. SIGNATURE
F. Granger

PITT - 1544 (2-70)

KNOWLEDGE AVAILABILITY SYSTEM CENTER
UNIVERSITY OF PITTSBURGH
PITTSBURGH, PA. 15213

1971
Frank Granger, President
Granger Electrical Manufacturing Co.
1011 First Street
New Kensington, Pennsylvania 15068

(Front)

INSTRUCTIONS

1. Check form of document required. (Documents on microfiche require special equipment for reading.)
2. Provide either the "Accession No." or "Report No." of the document. Sponsor's Series No. or Contract or Grant No. of report are unacceptable. Full document copy of citations which contain neither an accession no. nor a report no. are not available through KASC.
3. Provide the KASC assigned identification no. for your profile if this request is in response to a search performed for your profile.
4. Provide the computer tape number (or range of numbers) if this request is in response to a search performed for your profile.
5. Provide the KASC assigned identification number for your organization. **Requests for documents will not be processed without this item of information.**
6. Sign this form and mail to - KAS Center, University of Pittsburgh, Pittsburgh, Pennsylvania 15213.

(Reverse)

Figure 3-1. KASC Document Order Form

Additional information is requested by the form, such as the profile identification number, if any, for which the document has been requested, the number of the monthly NASA tape or retrospective tape which was searched, and the mailing address of the requestor. The last item is, of course, essential before a request can be completed but it is not essential for the initial processing steps of the request and may be added at a later date. Order forms transmitted to C/A subscribers with their search output have been stamped with the clients' mailing addresses and numeric identifications. Profile and tape searched identification are requested because a document request in response to a search is considered as an evaluative action. Such feedback is essential for monitoring the search system and for identifing the utilization of aerospace technology by the nonaerospace segment of industry.

The document order form serves as more than an order form. That portion of the form containing the document identification and medium requested is later separated from the mailing address and utilized as a "packing slip" enclosed with the document copy mailed to the client. The address portion then serves as a mailing label for the packaged document.

Processing the Requests

Document orders received at the request processing desk without any notations relating the document to a client's profile or search performed for the profile are frequently accompanied by evidence which enables a

clerk to associate the requests with a specific profile or search. If such occurs, the initial processing step is to add the missing information to the forms. The evidence relied upon predominantly is the KASC search evaluation form which has been generated as the computer printout of the search results. A copy of the form accompanies all search results with a request that the client complete and return the form after reviewing the abstract packet. The client usually returns the evaluation form with his document order forms. This initial step does not contribute to complying with a client's request for a copy of a specific document, but, as mentioned above, it is considered by the KASC as valuable information for evaluation of its information systems.

The first step which does lead to filling the document order is to scan the request for the presence of essential information. For client's who fail to specify a document medium, a choice of hard copy is made for them. Requests providing document identification numbers other than NASA accession numbers or publishing agency's report numbers are rejected and returned to the requestor for the correct information. Clients' organizational identification numbers which are missing must be obtained from the KASC records. All other information items which have not been supplied by the client or the receiving clerk are filled with zeroes.

The Document Handling Form

As a first task each morning, information from the scanned order forms is keypunched onto a Hollerith card which serves as a handling form in the subsequent processing steps and as a record of the transaction for invoice purposes and later statistical analysis of the document service. The Hollerith card requires a special format (Figure 3-2) for the manual recording of data pertaining to subsequent processing steps which are punched onto the card after the document copy is mailed to its requestor. The data transcribed from the document order form during the initial keypunching operation includes the following:

1. The medium in which the document copy is requested.
2. The NASA accession number or publishing agency's report number of the document requested.
3. The identification number of the client's profile, if any.
4. An indicator (R or C) of the type of search, i.e. retro or C/A, provided for the client's profile, if any.
5. The NASA tape searched, if any.
6. The identification number of the client's organization.
7. The date the client's request was received by the KASC.

The terminal keypunching operation is also performed at this time for those document requests which have been filled (Figure 3-3). As just stated, in the process of filling the client's request, data is recorded on the partially punched document handling form. That data is now punched in the remaining unpunched columns of the card and includes the following:

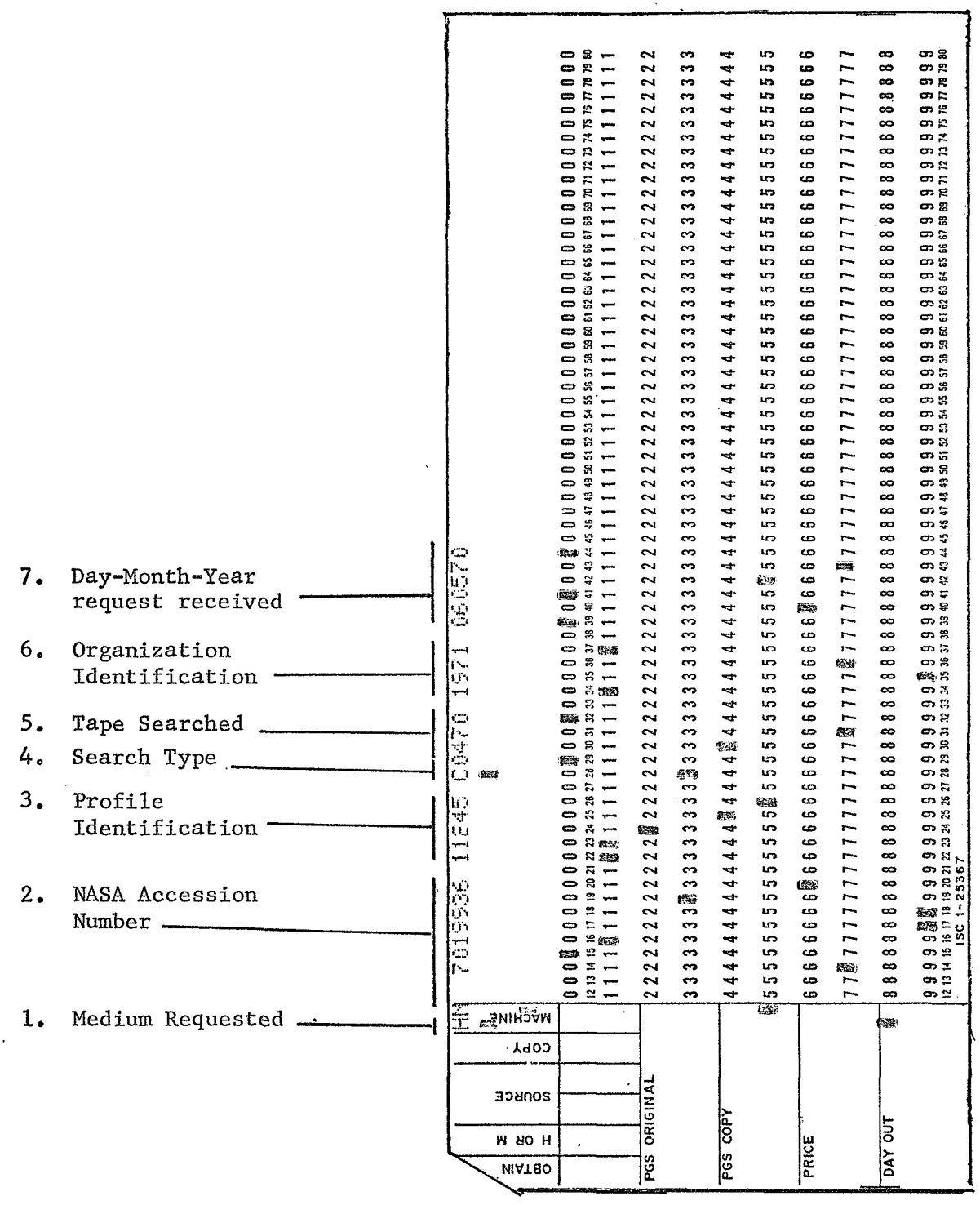


Figure 3-2. KASC Document Handling Form--Initial Keypunching Stage

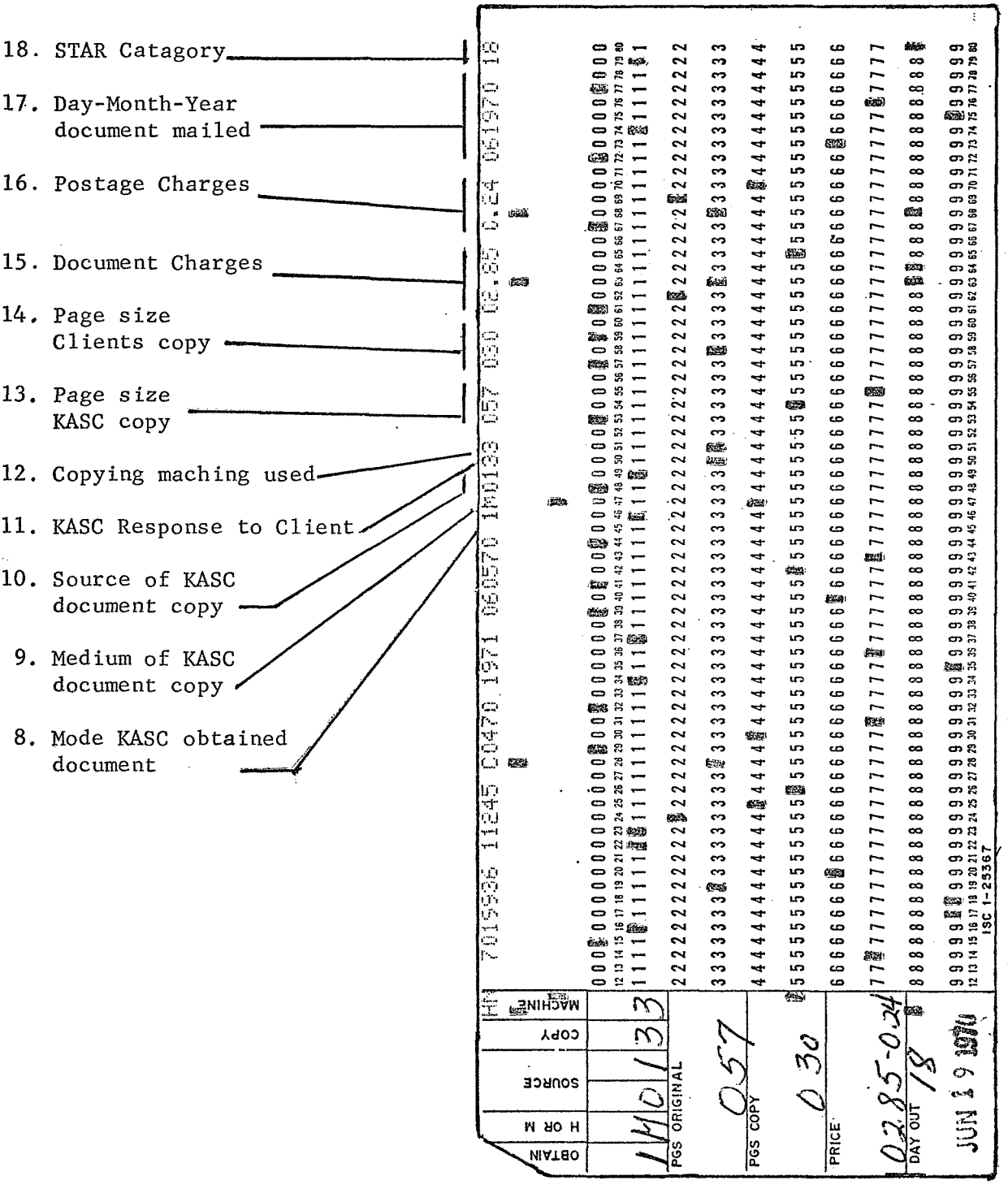


Figure 3-3. KASC Document Handling Form--Terminal Keypunching Stage

8. A numeric identification of how the document copy used by the KASC was obtained.

   (1) KASC holdings including standard distribution from NASA
   (2) Interlibrary loan
   (3) Purchased from supply source
   (4) Obtained free from supply source
   (0) Client's request rejected

9. Medium of document copy used by the KASC.

   (H) Hard Copy
   (M) Microfiche
   (0) Client's request rejected

10. Source from which document copy used by the KASC was obtained.

   (01) Standard distribution from NASA
   (02) Special requisition from NASA
   (03) (Various organizations which sell, loan, or provide copying services for documents contained within the NASA information resource.)
   (00) Client's request rejected

11. KASC response to its client.

   (1) Copy loaned to client
   (2) Copy obtained by KASC delivered to client
   (3) Copy reproduced by KASC delivered to client
   (4) Client's request rejected
   (5) Document supplied as part of another document
   (6) Copy supplied to client returned for credit

12. Copying machine used.

   (1) No machine
   (2) Xerox Copier
   (3) ITEK Reader/Printer
   (4) FILMAC Reader/Printer
   (5) Atlantic Microfilm Printer and Developer
   (6) A. B. Dick Copier
   (0) Client's request rejected

13. Page size of the document copy used by the KASC in filling its client's request.

14. Page size of the document copy supplied to the KASC client.

15. Cost to client of document supplied.

16. Postage charges.

17. The date the document copy was mailed to the client.

18. The STAR Subject Category number of the document.

The Audit Trail

A second task each morning is to sort and list the document handling forms just keypunched. Two sets of cards are listed:

- Document handling forms for requests received during the past 24 hours.
- Document handling forms for requests filled during the past 24 hours.

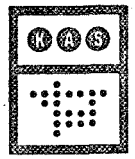
Using an IBM 1053 Printer and an IBM 1056 Card Reader, printouts of the two sets of cards are obtained. Each line item of the first group represents a document request for which action is required. When that action has been completed, it will be attested to by the appearance of the handling form with its additional data in the listing of the second group, each line item of which represents a document request for which all action has been completed. Items of the completed-requests listing are located on their respective requests-received listings and their entries lined out. Unlined entries of requests received represent document orders for which action is still pending. A daily audit of the incompleted requests-received lists prevents the inadvertent failure to act upon a client's document request.

The Microfiche File and Microfiche Reproduction

Upon completion of the listing of the keypunched document handling forms, the newly generated handling forms are collated with their respective document order forms. Each pair is inserted in a small carrier envelope and dispatched to the appropriate clerk for the third step in fulfilling the document request of a client. Those handling forms representing filled document requests are filed for end-of-month invoice reports and statistical analysis.

Requests for microfiche copies of documents are immediately delivered to the reproductions clerk for duplication of the required microfiche. The microfiche documents received from NASA are maintained in eight drawer, double row, 4 x 6 inches card filing cabinets in the numerical sequence of the document accession numbers. The clerk encodes the additional data required for the document handling form and forwards a duplicate microfiche copy with its document order and handling form to the mailing station where the document copy and "packing slip" are packaged and mailed to the client. The handling form is then delivered to the keypunch clerk for terminal punching the following morning.

When a client has requested a microfiche copy of a document not available in that medium, the clerk encodes the document handling form to reject the request and returns it with the document order form to the request processing desk. The processing clerk then completes a form (Figure 3-4) explaining the KASC inability to fill its client's request and returns the document order with the form to him by mail.



THE KNOWLEDGE AVAILABILITY SYSTEMS CENTER
UNIVERSITY OF PITTSBURGH • PITTSBURGH, PENNSYLVANIA 15213 • PHONE 621-3500

RESPONSE TO DOCUMENT REQUEST

Document _____ Requested by _____

Per: Question number _____, Search period _____; Other _____

A COPY OF THE DOCUMENT REQUESTED

WILL BE DELAYED IN DELIVERY

__ The document is presently in use but will be forwarded to us as soon as it is returned to the AIAA library.
__ The document has been lost, but it will be forwarded to us as soon as it is replaced by the AIAA library.
__ The document is out of stock, but it is being reprinted. A copy will be forwarded.

IS NOT AVAILABLE.

__ The document has been lost and cannot be replaced by the AIAA library.

__ The document has not been accessioned for STAR or IAA bulletins.

__ The document is copyrighted and the available stock of reprints has been depleted.
__ The original document is of such poor quality it cannot be reproduced in legible form.
__ The document is obsolete and has been withdrawn from circulation.

__ Repeated attempts to obtain the document have been unsuccessful.
__ The document has not been produced in the medium requested.

IS INADEQUATELY IDENTIFIED.

__ Please furnish the correct accession number or report number as published in STAR or IAA bulletins.
__ The accession number or report number cited is not valid. Please check your reference and request again.

MAY BE OBTAINED FROM

__ Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20401.
__ Clearinghouse for Federal Scientific & Technical Information, Springfield, Virginia 22151.

Figure 3-4. KASC Standard Response Form

When a client has requested a microfiche copy of a document which is out-of-file, the reproductions clerk must depend upon the presence of some sort of file marker or signal to locate the KASC copy. The signal can indicate one of the following:

- The document is in use by another staff member of the KASC.
- The document is in a waiting line for reproduction of microfiche or hard copy.

In the prior case, it is a simple matter of retrieving the document from the user (file copies of documents may not be removed from the KASC offices) and proceeding with its duplication using a diazo film printer and developer. In the latter case, the client's order for the document is added to the one or more already received from other clients and all requests for the document are filled at the same time.

In place of a signal, the reproductions clerk may find an information card directing her to take some action or providing some information concerning the desired document which will affect her manner of filling the client's document order. These informative notes can include one or more of the following:

- "See vertical file."
- "Not available on microfiche."
- "Quality too poor for reproduction."

The first message results from a discovery of the conditions described by the second or third message after receiving a request for the document. Microfiche of such poor quality that a legible duplication or print-out

of the document is impossible to achieve results in a delay in filling a client's order while a better copy of the document is requisitioned from NASA. If this is not forthcoming, the client's request for microfiche copy must be rejected and an information card containing the third message, above, is inserted in the microfiche file. Poor quality microfiche from NASA does not necessarily presage illegible hard copy from some other source. In anticipation of the rejected client resubmitting his order with a change to hard copy or of the receipt of an order for the document from another client, the attempt to obtain hard copy of the document is made and, if successful, the copy is stored in a vertical file. A cross reference to the vertical file is added to the information card previously inserted in the microfiche file at the address of the document. Thereafter, microfiche copy orders for the document must continue to be rejected but hard copy orders can be quickly filled.

A similar phenomenon occurs when it is discovered that a NASA information resource document is not available to the KASC on microfiche. This discovery is dependent upon the absence from the microfiche file of either a signal or an information card. This fact is indicative of one of the following:

- The document has been misplaced.
- The document is not available on microfiche.
- Distribution of the document by NASA is restricted and the KASC must obtain it from other sources, if possible.
- The document was inadvertently omitted by NASA in the standard distribution of microfiche document copy.
- Standard distribution of the microfiche document copy by NASA has not yet been performed.

As mentioned in the Overview of Section II, NASA automatically provides its regional dissemination centers with one microfiche copy of most of the documents announced through its bulletin STAR. A quick reference by the reproductions clerk to the Accession/Report Number Index of that bulletin will determine whether or not a missing item is available on microfiche by the presence or absence of a pound sign (#) following the accession number of the item. The absence of the pound sign indicates the unavailability of the document on microfiche. If this is the condition, an information card with the note "Not available on microfiche" is filed for future reference at the address of the document in the microfiche file. A client's order for microfiche which has led to the discovery of the absent microfiche is of course immediately rejected.

It is possible for a client to request a copy of a document which is available on microfiche but before NASA has performed its standard distribution of microfiche. If so, the fact that the most current issue of STAR is required to determine the availability of the document is sufficient to recommend that the client's request be deferred for a week. If the microfiche copy has not been received by that time, a special requisition for the document is mailed to NASA.

For documents whose publishers place a restriction on their distribution by NASA, the pound sign (#) does not appear with the document accession numbers of the STAR indexes. Therefore, the third condition listed above is equivalent to the second, "The document is not available on microfiche," and the reproductions clerk acts accordingly.

Missing microfiche for which copies are available, according to the STAR index, have either been misplaced or inadvertently omitted by NASA in its standard distribution. Which ever may be the case, a microfiche copy is immediately requisitioned from NASA rather than attempt an exhaustive search. If the microfiche copy has been misplaced it has probably been misfiled and an item by item search through the file would be too costly to perform.

Hard Copy Production

Even though the purpose of this experiment is the provision to KASC clients of hard copy of documents from the NASA information resource, attention has been directed to the microfiche reproduction as a more simple means of describing the microfiche document file. It is this file, provided to the KASC by NASA, which is basic to the provision of hard copy upon demand.

When the handling forms have been generated for the newly received document requests and collated with their corresponding document order forms, those representing requests for hard copy could well accompany those representing requests for microfiche copy to the reproductions clerk. Where the clerk fills the microfiche request by duplicating a copy of the microfiche document from the KASC files, she fills the hard copy request using the same microfiche document file but instead of the diazo duplicator the enlargement-exposure-development processes of a microfiche reader/printer are utilized. After producing the hard copy,

she encodes the additional data required for the document handling form and forwards the hard copy with its document order and handling form to the mailing station. There the document copy and "packing slip" portion of the order form are packaged and mailed to the client. As with the microfiche request, the handling form for the hard copy request is then delivered to the keypunch clerk for terminal punching the following morning.

The hard copy document service is influenced by a factor that the microfiche copy document service is not. That factor is the number of pages contained within the document to be reproduced. Hard copy documents are produced by the KASC at a per page cost to its clientele; microfiche copy is provided at a per document cost to the client.

It is the KASC policy to provide to its clientele hard copy of documents at the least cost. The current per page cost charged by the Center is $.05. A document over 60 pages, therefore, would cost the client more than $3.00 if reproduced by the KASC. The great majority of the documents within the NASA information resource as announced in STAR are available to the general public through the Clearinghouse for Federal Scientific and Technical Information (CFSTI). During this experiment, hard copy of documents regardless of their page length were sold by the CFSTI for $3.00 each. Clearly, an economy minded KASC client would take careful note of the bibliographic citation for a document he has selected to determine its page length and the cheaper source of supply. Ordering from more than one source requires compliance with an additional organiza-

tion's prerequisites of service, stocking of that organization's forms, and issuance of prepayments for document orders or redeemable coupons or processing of additional invoices. It becomes just as obvious that such practice would be a false economy particularly if the majority of the documents required by the client were under 60 pages in length and were available from a supply source at a rate of $.05 per page rather than at a fixed cost of $3.00. Added to the argument for false economy is the fact that the supply source guarantees not to reproduce for the client any document when it can be obtained for the client elsewhere at a per page rate of less than $.05. The KASC becomes an even more attractive supplier of documents for its clientele where the document desired is a section of a larger document which must be purchased in its entirety from other suppliers, as with the U.S. Government Printing House (GPO). For instance, a four-page article from a publication sold by the GPO for $8.50 would cost the KASC client only $.20.

This is not to say that the above practice can be followed by the KASC for every document within the NASA information resource regardless of its source. Copyright and distribution restrictions can force the KASC to act merely as a purchasing agent for its clients. Even so, the one-stop-shopping center for both search and document services has an appealing simplicity and economy for the KASC clientele.

The initial effect of the page length factor on the provision of hard copy of documents by the KASC is to interrupt the direct flow of the

document order and its handling form from the keypunch operator to the reproductions clerk. Additional information concerning the document requested is required before the next step in copy production can be taken. The information, most readily available from the abstract published in STAR, includes the following:

- availability of microfiche copy
- page length
- sales price
- source available

The KASC maintains for production of search output a file of 3 x 8 inches cards each containing a copy of an abstract which has been announced in STAR. The abstracts are filed in sequence of their document's accession numbers. The information items listed above are obtained from this file by the processing clerk to whom the requests for hard copy have been diverted. Using the information as it appears in the bibliographic citation, she is responsible for deciding which of 15 different possible modes of action must be taken in response to each client's request.

The possible modes of action are combinations of different states of three different variables:

1. The origin of the document copy to be used by the KASC for filling the document request.

   (a) KASC file copy
   (b) Copy to be purchased
   (c) Copy to be obtained at no cost

2. The medium of the document copy to be used by the KASC

   (a) Hard copy
   (b) Microfiche

3. The mode of response to be taken by the KASC

   (a) Document copy obtained by KASC to be supplied to client
   (b) Document copy reproduced by KASC to be supplied to client
   (c) Client's document request to be rejected

Although 18 different possible combinations can be constructed from these variables, three of them are impossible as a mode of action for providing hard copy. A microfiche document copy used by the KASC (2b) can never be the hard document copy obtained by the KASC to be supplied to a client (3a) regardless of its origin (1a, b, or c).

The first item of information affecting the processing clerk's choice of action mode is the availability of the document on microfiche. The presence of the pound sign (#) following the document's accession number on the abstract indicates that it is available on that medium, and, therefore, a microfiche copy should be in the files of the KASC. The next two items of information which she requires are the number of pages contained within the document and its selling price, if any. If the page length equals or is less than 60 pages and a selling price is provided that equals a per-page rate of more than $.05, the clerk tentatively selects a combination of the variables listed above which state that the document copy to be used is one from the KASC file (1a), which is microfiche (2b), and will be reproduced by the KASC (3b). These variables constitute data items 8, 9, and 11 of the handling form (Figure 3-3) which are keypunched onto the form in the terminal key-

punching operation. Items 10 and 13 (source of KASC document copy in a page size of KASC copy) of the document handling form are also tentatively selected by her at this time and the data penciled onto the form in the spaces provided to the left of the card.

The document order form and its handling form are passed on to the reproductions clerk who reacts to the request in the same manner described earlier for microfiche reproduction except that instead of duplicating the KASC microfiche copy, she prints out hard copy using a microfiche reader/printer. The prediction of the processing clerk that the document will be printed in-house from a KASC microfiche copy is not always accurate. The reproductions clerk may encounter one or more of the same problems previously described in microfiche reproduction. The KASC file copy may be of such poor quality that a substitute must be requested from NASA thereby changing the origin of the document copy from (1a) the KASC file copy to (1c) a copy to be obtained at no cost. Previous requests for the same document may have caused the KASC to supplement its microfiche file with a hard copy of the particular document thereby changing the medium of the document copy to be used from (2b) microfiche to (2a) hard copy. Again, previous requests for the document may have proven the abstract copy which appeared in STAR to be erroneous and the document to be unidentifiable or unobtainable thereby changing variables 1 and 2 to zeros and the mode of response to be taken by the KASC from (3b) a KASC reproduced copy supplied to the client to (3c) a rejection of the client's request.

When the processing clerk is initially choosing the KASC action mode in relation to a client's hard copy document request, the abstract of the document may reveal one of the following:

- that the required document is available on microfiche, is less than 60 pages in length, and is priced by a source for less than $3.00
- that the required document is available on microfiche but is greater than 60 pages in length
- that the required document is not available on microfiche

For each of the above conditions, the fourth information item is required from the abstract which is the name of the supplier. The effect of any one of the conditions is to divert the document request and order form from the reproduction cycle described above to a purchasing cycle. The processing clerk proceeds to order the document from the supplier, cross references and files her purchase order copy, and files the client's document order form and handling form in a pending file to await receipt of the document copy. For future reference, a copy of the document abstract is inserted with the client's order form. Action by the KASC for the purposes of its client has been suspended and can remain so indefinitely unless some sort of tickler system prompts the processing clerk to attempt to dissolve the state of suspension. The Audit Trail, discussed earlier, serves this purpose through the addition of a notation to the appropriate requests-received listing of document handling forms providing the date a purchase order was issued to a supplier. The daily audit of the incompleted requests-received lists reveals any unreasonable time lapse since a document was ordered. In the event such occurs, the clerk follows-up her order with

a query or looks for other possible suppliers. The failure of any supplier to respond to a KASC purchase order or receipt of a negative response from all suppliers approached will cause her to reject the KASC clients request with an appropriate response.

When the document ordered from a supplier has been received, the processing clerk retrieves her copy of the purchase order from file which is cross references to the appropriate KASC client document order. The client's document order and handling form are then retrieved from the pending file, the document and "mailing label" portion of the order form are packaged and mailed to the client, and the handling form is encoded with the additional required data and forwarded to the keypunch clerk for terminal punching the following morning.

The processing clerk also handles purchase orders for hard copy of documents to substitute for poor quality KASC microfiche copies and requisitions microfiche copy of single documents from NASA to replace items missing from the KASC file. These actions are handled in the same manner as described above for filling hard copy requests which can be obtained more economically than the KASC can produce them. The tickler system is as important in former actions as in the latter. The purchase orders and requisitions are prompted by a KASC client's request for document service and KASC action in providing that service has been suspended.

Rejection of Clients' Requests

Rejection of a client's document order either for microfiche or hard copy has been mentioned. Where the KASC is unable to provide a client with a microfiche copy of a document contained within the NASA information resource, the document was not available to the KASC on that medium. Even though KASC clients are provided with an example of a typical citation from STAR with each search output, many either fail to realize the significance of the pound sign (#) as an indicator of the availability of microfiche for the document or elect not to bother with this detail until the KASC has rejected their request.

The human quality which ignores detail and enjoys convenience also accounts for the vast majority of the hard copy requests which the KASC rejects. The economy minded client, mentioned earlier, seems not to exist. Few of the KASC clients take notice of any document selling price that may have been included in the abstract or bother to calculate the cost to them at a rate of $.05 per page. When the KASC receives a request for hard copy of a document whose cost to the client would be approximately $10.00, the processing clerk notifies the client before processing his request. Almost as a matter of course the client cancels the order which is then counted as a reject.

Personnel

Operation of the KASC document service is performed through the services of three full-time and one part-time KASC staff members. Two of the full-time employees consist of an administrative aide, who is responsible for the operation of the service and the accomplishment of timely document service to KASC clients, and a senior clerk, who is responsible for the reproduction of microfiche and hard copy documents from microfiche and the maintenance of the microfiche file. The administrative aide serves as processing clerk in addition to her supervisory and administrative duties and is responsible for initiating action to comply with a KASC client's document request, for the reproduction of hard copy documents from hard copy, for the purchase from suppliers of documents required by KASC clients, for the packaging and mailing of document copy to clients, and for the recording and collection of statistical data descriptive of the service. Assisting her is a part-time clerical aide who serves one-third time. Keypunching services required by the KASC document service are provided by a full-time clerk of the KASC of whom approximately one-fifth of her time is required by the document service.

The above personnel are responsible for all document service provided by the KASC of which requests for documents from the NASA information resource constitute 50% of the document orders received. For the NASA documents only three of the above four persons are required for the following percentages of their time: administrative aide (50%), senior clerk (100%)

and keypuncher (10%). Based on a man year of 1,950 hours, a total of 3,129 man hours per year are required by the KASC to provide document service from the NASA information resource.

Requests for NASA documents in hard copy constitute approximately 75% of all NASA document orders. While the percentage of time devoted to NASA hard copy is appropriately reduced for the administrative aide and the keypuncher to 32.5% and 7.5%, respectively, the senior clerk's time is reduced only to 87.5% by virtue of the fact that one-half her time is devoted to file maintenance which would continue to be performed were all requests received for NASA documents to be requests for hard copy. Total annual man hours required, therefore, by the KASC to provide hard copy document service from the NASA information resource is 2,584.

Equipment

Equipment utilized in the provision of document service based on the NASA information resource is as follows:

- IBM Keypunch 026
- IBM 1053 Printer and 1056 Card Reader
- ITEK 18-24RS Reader/Printer
- Atlantic Microfilm A-9 Printer and D-22 Developer
- Xerox 3600I Copier
- General Binding Corporation Binder

The keypunch and IBM printer and card reader are used in the preparation of the document handling forms and the daily generation of the listing of those cards representing newly-received document orders and those representing completed document orders.

The ITEK reader/printer, Atlantic Microfilm printer and developer and Xerox copier are utilized for the actual production of the document copy required by the client. In using the ITEK 18-24RS for the production of hard copy, the machine is loaded with 11 inch wide paper and its screen is masked to expose simultaneously two frames of a microfiche document. The resulting page size of the hard copy is 11 x 15 inches. Microfiche copy reproduced using the Atlantic Microfilm A-9 Printer and D-22 Developer is the same size as the microfiche copy contained within the KASC files which has been produced by NASA to COSATI standards. Documents reproduced using the Xerox 3600I Copier are those from the KASC's vertical file of hard copy documents which supplements the microfiche document file. The document is reproduced on standard 8½ x 11 inches paper or 8½ x 14 inches paper, depending upon the file copy obtained by the KASC.

All hard copy documents produced by the KASC are bound between paper covers using the General Binding Corporation Binder to punch the required slots along the left margin for use of a plastic element binder.

IV. RESULTS AND DISCUSSION

Data pertaining to three major variables are required for the evaluation of the KASC decentralized system for providing hard copy of aerospace generated scientific and technical information contained in the NASA information resource to meet the requirements of its clientele. The three major variables are:

- The demands placed upon the KASC as a result of services provided to its clientele for documents in the NASA information resource.
- The accessibility to the KASC of a copy of each document required by its clientele.
- The capacity of the KASC to produce hard copy of the required documents.

The Time Base

Data descriptive of the first two major variables listed above has meaning only in relation to a specified time period which must be sufficiently long to account for a changing clientele and their seasonal demands. A twelve month period of service by the KASC was selected as an appropriate length of time to overcome those uncontrolled variables. Originally, it was intended that the period July 1967 through June 1968 would serve. Close observation of the data collected during that period, however, proved that essential data classes had been omitted. Changes by the KASC in the services offered to its clientele which were introduced during the last six months of 1968 critically affected the Center's clientele requirements in search and document service, postponing the

period of data collection. The period of time finally selected for study was made to coincide with the KASC annual year of service as a NASA regional dissemination center which is from the month of March through the month of February of the following year. The results of the study presented below, therefore, cover the period March 1, 1969, through February 28, 1970.

Clientele Service Requirements

During the period March 1969 through February 1970 the KASC provided search services based on the NASA information resource to 93 different organizational clients which collectively represented 590 different profiles or individual subject areas of interest for which references from the NASA document collection were expected to yield useful information. The types of searches required for the 590 profiles were as follows:

• Current Awareness Only	448
• Retrospective Only	70
• Combination of Both	38
TOTAL	556

Considering the current awareness service separate from the retrospective, the 38 profiles which received both types of searches are added to both the current awareness only and retrospective only with the result that during the year of this study 486 profiles required current awareness searches and 108 required retrospective searches.

Current Awareness Service

As mentioned under Search Types of Section II of this report, current awareness (C/A) service is seldom obtained by a client on an ad hoc basis; the client ordinarily contracts for a consecutive series of C/A searches for a specified period of time, usually 12 months. If this were true of the 486 profiles for this study, a total of 5,832 C/A searches would have been performed. Instead only 4,311 C/A searches were performed due to the attrition of profiles whose 12 months period of service began before March 1969 plus the introduction of new profiles after March 1969. As a result, each of the 486 profiles received an average of 8.9 C/A searches.

During the March 1969 through February 1970 time period, NASA announced through its semimonthly bulletin STAR a total of 31,504 documents which had been added to its information resource. This quantity constitutes an average of 2,625.3 documents per month or per KASC C/A search. Thus, for the 486 C/A profiles of this study, each received searches covering an average of 23,265.2 documents (2,625.3 documents x 8.9 C/A searches).

As a result of its C/A searches for the 486 profiles, the KASC forwarded to the profiles' users a total of 56,404 abstracts of documents accessioned and announced in STAR during the year by NASA. During the 12 month period, for the average C/A profile this represents 116.1 abstracts for which the user selects documents whose full copy he would like to see.

The effect of the KASC service types, discussed in Section II, upon the document selection opportunities afforded KASC C/A clients is seen in the following discussion.

Distribution among the KASC service types of the 486 profiles and the 56,404 abstracts, mentioned above, and the corresponding average abstracts per profile during the year is as follows:

	Profiles	Abstracts	Abstracts/Profile
Type II	131	10,005	76.4
Type III	338	44,309	131.1
Type IV	17	2,090	122.9
TOTALS	486	56,404	116.1

The fact that a Type IV profile, in which the same output may be distributed to more than one user, does not prevent us from equating each of the 486 profiles with 486 users. During the year of study, the 17 Type IV profiles served by the KASC were distributed to an average of only 20 users. Substitution of 20 users for 17 Type IV profiles in the above tabulation has a neglible effect on the abstracts per profile even when the quantity of Type IV profiles is proportionately increased to account for the slightly larger distribution.

From the figures above, it is apparent that during the year of study not all C/A clients received an equal opportunity to select the same quantity of documents from among the 22,265.2 average documents which were searched for each profile. The 338 Type III users were offered

an average selection of 131.1 documents, the 17 Type IV users were offered an average selection of 122.9 documents, while the 131 Type II users received an average of only 76.4.

Retrospective Service

For comparison between the effect of C/A and retrospective service, the latter must be converted into units comparable to those of the first, i.e. a retrospective search must be converted to its equivalent in C/A searches. A search of the whole document file of NASA goes back to April 1962. By the end of our study year, February 1970, a profile requiring retrospective service would have covered the equivalent of 94 C/A search periods. As with the C/A profiles, however, not all profiles submitted to the KASC by its clientele were received in time to have covered the entire possible range. As a matter of fact, only the last ten profiles requiring retrospective service each received the equivalent of the 94 C/A searches. On the other hand, profiles submitted for retrospective service at the beginning of the study year, March 1969, could receive the equivalent of only 82 C/A searches which was the fate of 13 of the 108 profiles requiring retrospective service. An average number of equivalent C/A searches for all profiles receiving retrospective service was determined by converting the range of the retrospective search for each profile into equivalent C/A searches and dividing the sum of all C/A search equivalents by the total number of retrospective profiles. Using this method, each of the 108 profiles requiring retrospective service received an average of 87.6 C/A equivalent searches.

During the period April 1962 through February 1970, NASA announced in STAR a total of 193,249 documents or an average of 2,984.6 documents per KASC C/A search for retrospective service. Thus, for the 108 retrospective profiles of this study, each received a search covering an average of 182,610.9 documents (2,084.6 documents x 87.6 C/A searches).

As a result of its retrospective searches for the 108 profiles, the KASC forwarded to the profiles' users a total of 33,321 abstracts of documents accessioned and announced in STAR through February 1970. During the 12 month period of study, for the average retrospective profile this represents 308.5 abstracts from which the user selected documents for purchase.

The effect of the KASC service types upon the document selection opportunities afforded KASC retrospective clients is shown in the following distribution:

	Profiles	Abstracts	Abstracts/Profile
Type II	54	14,941	276.7
Type III	54	18,380	340.4
TOTALS	108	33,321	308.5

Because Type IV service is limited to C/A searches, only two of the three KASC service types utilized by the Center's clientele affect its document demands. As with the C/A, retrospective Type III users were offered on the average a larger number of abstracts (340.4) from which to select documents than were the retrospective Type II users (276.7).

Summary

The KASC clientele search service requirements for the period March 1969 through February 1970 were measured by the numbers of different profiles submitted for service during that period. Three service types, requiring C/A searches, retrospective searches, or both, were demanded for a total of 556 profiles as shown in the following distribution:

	C/A Only	Retrospective Only	C/A and Retrospective	Total
Type II	117	40	14	171
Type III	314	30	24	368
Type IV	17	-	-	17
TOTALS	448	70	38	556

The average C/A search performed for profiles requiring such service covered 23,265.2 documents accessioned by NASA and announced in its semimonthly bulletin STAR during the period March 1969 through February 1970. The average retrospective search performed for profiles requiring such service covered 182,610.9 documents accessioned by NASA and announced in its semimonthly bulletin STAR during the period April 1962 through February 1970.

As a result of the C/A searches a total of 56,404 abstracts of the documents were forwarded to the profile users and as a result of the retrospective searches a total of 33,321 abstracts were forwarded. The average number of abstracts forwarded to recipients of the different

service and search types was as follows:

	C/A Only	Retrospective Only	C/A and Retrospective	All Searches
Type II	76.4	276.7	353.1	145.9
Type III	131.1	340.4	471.5	170.4
Type IV	122.9	-----	-----	122.9
All Service Types	116.1	308.5	427.8	161.4

The differences between the different service types has been discussed under Service Types, Section II. There it is stated that the predominate difference between Types II and III is one of abstract sequence in the packaged search results forwarded to a client. Abstracts of Type II service are packaged in the numerical sequence of the documents' accession numbers. The numerical sequence of abstracts in Type III service has been interrupted by a subject specialist who moves to the front of the package those abstracts of direct interest to the profile user. Users of each of the two service types receive abstracts of all documents cited by a search. The difference in average quantity of abstracts each receives, as a consequence, reflects the tendency of KASC clients to utilize Type II service for profiles of more narrow scope than those submitted for Type III service. Type IV service users, on the average, receive more abstracts than Type II users but fewer than Type III. It should be remembered, however, that not all abstracts cited for a Type IV profile are forwarded to the user, only those considered by a subject specialist as relevant to the interests of a user group are included. Were members of a user group of a Type

IV profile to receive all search cited abstracts they would receive on the average 276.5 abstracts each during the period of this study.

Documents Requested

During the period March 1969 through February 1970, of the 93 organizational clients receiving KASC search services based on the NASA information resource, 73 (78%) requested that the KASC supply them with 2,891 document copies. The 2,891 document requests represent an average of 31.1 documents per organizational client receiving service during the period of the study or an average of 39.6 requests per organizational client submitting document orders.

Two thousand four hundred seventy-five (86%) of the document requests were known to have resulted from document abstracts which the profile users received through KASC search services. The remaining 416 (14%) were received by the KASC without any indication of the requestor's source of knowledge of the document's existence. The 2,475 requests associated with KASC search services were distributed between the two search types by medium of document requests as shown in the following:

	Hard Copy	Microfiche	Total
C/A searches	1,703	497	2,200
Retrospective searches	212	63	275
Unknown	338	78	416
TOTALS	2,253	638	2,891

For the 486 profiles receiving current awareness searches and 108 profiles receiving retrospective searches during the year, the average request received per profile for those associated with KASC search services is as follows:

	Hard Copy	Microfiche	Total
Requests / C/A Profiles served	3.5	1.0	4.5
Requests / Retrospective Profiles served	2.0	.6	2.6

For all 556 profiles, the average document request unassociated with a KASC search was as follows:

	Hard Copy	Microfiche	Total
Requests / Total Profiles served	.6	.1	.7

Increasing the average requests for C/A and retrospective searches by the average document requests unassociated with search service, the average profile which the KASC served during the year of the study resulted in very few document requests submitted to the KASC as compared with the quantities of document abstracts in the NASA information resource which had been brought to the attention of KASC clients through its search services.

	Abstracts to Client	Documents Requested		Total
		Hard Copy	Microfiche	
C/A Only	116.1	4.1	1.1	5.2
Retrospective Only	308.5	2.6	.7	3.3
Combination of Both	427.8	6.8	1.8	8.5

The infrequent demand per profile for full document copy contrasts sharply with the clientele evaluation of the document abstracts which they received. During the period of the experiment, KASC clients evaluated 19,325 abstracts resulting from 2,956 C/A searches of which 72% were considered to be directly related to the profile and 6% were considered to be relevant to other interests. The average number of abstracts per profile per C/A search which were evaluated equals 6.5 (19,325 abstracts / 2,956 searches). Because our average profile received 8.9 C/A searches during the year, then during the year the profile user should have evaluated 57.9 abstracts 72% (41.8) of which were considered to be directly related to the profile and 6% (3.6) of which were considered to be relevant to other interests.

Having determined that during the year the average C/A profile received a total of 116.1 abstracts, the aforegoing suggests that 78% (90.8) of these abstracts have some degree of interest to the profile user. Yet, on the average only 5.2 documents were requested.

Similarly, for the retrospective service, 3,166 abstracts resulting from 90 searches were evaluated of which 47% were considered to be directly related to the profile and 16% were considered to be relevant to other interests. Extending these proportions to the average retrospective profile which receives 308.5 abstracts, the profile user is presumably interested in 63% or 194.4 abstracts. Yet, on the average only 3.3 documents are requested.

This comparison of clientele evaluations and document requests has questionable validity. The search results evaluated by KASC clients during the year of the study were not necessarily the same searches performed during that year and the profile users returning the evaluations were not necessarily representative of the profile users receiving search results. However it is sufficient to illustrate that one or both of the following characterize the KASC clientele:

- KASC clients do not require full document copy of all abstracts which they consider to be relative to their interests.
- KASC clients do not rely upon the KASC to provide every document from the NASA information resource which they may require.

Profile users requesting full document copy from the KASC were 329 (59.2%) of the 556 profiles served during the time period of the study. Their distribution among the service types was:

	Profiles Requesting Documents	% Profiles Served
Type II	87	50.9
Type III	231	62.8
Type IV	11	64.7
All Types	329	59.2

Extending the requirements of the 329 profile users to the total population of 556 profile users served, the average profile served, regardless of the search service it received, resulted in requests for 4.6 documents. The average document requests per profile by service type, however, is somewhat different.

	Document Requests	Profiles Served	Requests/Profile
Type II	571	171	3.3
Type III	1,756	368	4.8
Type IV	148	17	8.7
All Types	2,475	556	4.6

The above distribution omits the 416 document requests unassociated with search services, which when distributed evenly among the 556 profiles increases each of the above average requests per profile by .7 of a document.

By comparing the average document request per profile by service type with the average quantity of abstracts forwarded to the profile user we begin to discover the effect of the different KASC service types upon clientele document requirements.

	Document Requests	Abstracts Forwarded	% Abstracts Resulting in Document Requests
Type II	4.0	145.9	2.7
Type III	5.5	170.4	3.2
Type IV	9.4	122.9	7.6
All Types	5.3	161.4	3.2

On the basis of requests alone, it appears that the minimum number of possible users for most KASC standard interest profiles, Type IV service, has accounted for the highest average number of document requests and the highest ratio of document requests to abstract forwarded. It has

been previously mentioned that the low number of users per Type IV profile has resulted in the KASC service becoming a special subset of Type III service. The Type IV user not only has had the benefit of the subject specialist preliminary review, items judged nonrelevant by the subject specialist were not forwarded to the user so that his package of abstracts was enriched. Had the Type IV user received the average quantity of abstracts cited by a search, 276.5, the ratio between average document requests and average abstracts forwarded would be 3.4% rather than 7.6%, a percentage figure very similar to that for Type III service.

If, then, the KASC service types have an effect on document requests, the distinction is to be found in comparing Types II and III. Based on the above it is apparent that the greater average quantity of abstracts received by the Type III profile user plus the assistance of a subject specialist in identifying items relevant to the user's interests accounts for Type III users requesting a higher average number of documents than Type II users and for Type III users making slightly more "efficient" use of the abstracts they received than did the Type II users. The addition of the search type to the effect of service types on KASC clientele document requests reveals a surprising fact as developed in the following discussion.

The document requests received by search and service type is given below:

	C/A Searches	Retrospective Searches	Unknown	Total
Type II Service	510	61	-	571
Type III Service	1,542	214	-	1,756
Type IV Service	148	-	-	148
Unknown	-	-	416	416
TOTALS	2,200	275	416	2,891

Based on the above data, the average number of document requests received on the basis of search and service types becomes the following:

	C/A Only	Retrospective Only	C/A and Retrospective
Type II	4.6	1.8	5.7
Type III	5.3	4.7	9.3
Type IV	9.4	-	-

The 416 requests unassociated with search services have increased the average document request for each search-service type above by .7 document. The ratio between the resulting figure and the average number of abstracts forwarded for each search-service type enables us to see more clearly the effect of the KASC service types upon its clientele document requirements:

	C/A Only	Retrospective Only	C/A and Retrospective
Type II	6.0%	.7%	1.6%
Type III	4.0%	1.4%	2.0%
Type IV	7.6%	-	-

It is interesting to note that while the average Type II C/A Only user requested approximately 87% as many documents as did the average Type III

C/A Only user, the average Type II C/A Only user requested document copy for a greater proportion of the abstracts which he received. For retrospective service and the combination C/A and retrospective service, however, Type III service users requested significantly more document copies than Type II users and requested document copy for a greater proportion of the abstracts which they received during the year's service.

This analysis has limited utility for the evaluation of the KASC search service types. The primary obstacle to such use is the fact that 416 (14%) of the document requests received could not be associated with any one combination of the services offered. By prorating these document requests among all profiles served, a distorted relationship among the service types may have been obtained. This same factor works against use of the data for finite predictions of KASC clientele document requirements; however, generalizations can be made which are useful for this purpose.

Two variables affect the document requirements: the quantities of profiles and the quantity of abstracts forwarded to clients. Given the level of abstracts forwarded by search-service type during the period of the experiment, the quantities of profiles for each search-service type becomes the sole measureable controlling factor. It is possible for other uncontrolled factors to affect the KASC clients' demands, such as a dramatic change in the nature of the NASA information resource, but these would probably be reflected by an equally dramatic change in the

quantities of profiles the KASC clientele submits for service or a change in the clientele itself.

Under current conditions the rank order of document demand for the KASC search services is as follows, with a rank of 1 indicating the greatest demand

	Rank	Document Requests per Profile per Year
Type IV C/A Only	1	9.4
Type III C/A + Retrospective	2	9.3
Type II C/A + Retrospective	3	5.7
Type III C/A Only	4	5.3
Type III Retrospective Only	5	4.7
Type II C/A Only	6	4.6
Type II Retrospective Only	7	1.8

A change in the stability of the NASA information resource in terms of its subject scope and mission orientation is the most obvious factor which could alter the average quantities of abstracts the KASC forwards to its clientele for each of its search services. Not so obvious are modifications made by the KASC, intentionally or unintentionally. A more effective search program is an example of an intentional change; the development of an undiscovered defect in the KASC computer magnetic tapes, the mechanically searchable medium containing the analytics of the NASA information resource, is an example of an unintentional change. Either of these changes would equally affect all search-service types unless the hypothetical

tape defect occured after the C/A search was performed. In this case the effect would be restricted to only the retrospective search service. On the other hand, an intentional change by the KASC in only one of its service types could bring about changes in only that search service combination and affect the overall document requests of the KASC clientele. As an example, KASC retrospective searches are now performed for the entire file, 1962 to the most current monthly tape. The average profile user receives 308.5 abstracts from the NASA information resource in a single mailing. The quantity of items which he must read is suspected of being a deterrent to effective use of the search results by the client. If he were offered retrospective search service on a yearly basis, i.e. each of the past years' accessions would be searched one year at a time, the proportion of relevant abstracts received by our profile user could result in a larger number of document requests. It is possible then that our document demand rank order of KASC search services could be easily altered by a decrease in the quantity of abstracts forwarded to the KASC clientele.

Summary

During the period March 1969 through February 1970, the KASC clientele requested 2,891 copies of documents from the NASA information resource which had been announced in STAR. Of the total documents requested, 2,253 were for hard copy and 638 were for microfiche. The average request per profile receiving service during the year was as follows:

	Hard Copy	Microfiche	Total
C/A profiles	4.1	1.1	5.2
Retrospective profiles	2.6	.7	3.3

Evaluation of the abstracts received by KASC clients indicate that 78% of the average C/A search result and 63% of the average retrospective search output are of interest to the profile user. Because the average C/A profile receives 116.1 abstracts per year, 90.8 abstracts of those received should have been of interest; yet, the user requested full document copy for only 5.2. Because the average retrospective profile receives 308.5 abstracts per year, 194.4 abstracts of those received should have been of interest; yet, the user requested full document copy for only 3.3.

Variation between the KASC search service types existed for the average number of document requests submitted ranging from a low of 1.8 documents per year for Type II retrospective only to a high of 9.4 documents per year for Type IV C/A Only. Each type did not request full document copy for the same proportion of the abstracts received, however. The service resulting in the fewest document requests, Type II retrospective only, also had the lowest ratio of document requests to abstracts received (.7%), but Type II C/A only service, which was sixth in average document requests, had the highest ratio of document requests to abstracts received (6.0%), excluding Type IV service. The rank sequence for all search service types for average document requests and ratio of document requests to abstracts received is given below:

	Average Document Requests Received	Ratio of Document Requests to Abstracts Received
Type IV C/A Only	1	1
Type III C/A + Retrospective	2	4
Type II C/A + Retrospective	3	5
Type III C/A Only	4	3
Type III Retrospective Only	5	6
Type II C/A Only	6	2
Type II Retrospective Only	7	7

Based on the KASC clientele demands for document service during the year of this study, the experience of the KAS Center indicates the following:

- KASC clients do not require full document copy of all abstracts which they consider to be relative to their interests.
- KASC clients do not rely upon the KASC to provide every document from the NASA information resource which they may require.
- Under the conditions of search service provided by the KASC during the year, the numbers of document requests which will be submitted by the KASC clientele is directly related to the numbers of profiles by search service type. In general, C/A search service results in more document requests than does retrospective search service with the combination of C/A and retrospective exceeding either of the single search types.
- Changes in the total information service system without changes in the conditions of search service by the KASC will probably equally affect the document requirements of KASC clients for each search service type, depending upon the system change.
- Changes in the conditions of KASC search service whether equally or unequally affecting each search service type will probably have differing effects upon the document requirements of KASC clients for each search service type. It is suspected that profile user behavior is affected by the quantities of abstracts he receives at any one time as a result of search service. A

porportionately equal increase in the number of abstracts forwarded to a client for each search service could result in less efficient use of Type II search output with no change in the numbers of document requests but in more efficient use of Type III search output with an increase in the numbers of document requests. A decrease in the number of abstracts forwarded to a client for a retrospective search with no change in the number forwarded for a C/A search could result in more efficient use of the retrospective search output resulting in an increase in the number of document requests with no change in document requests for C/A search output.

Document Request Responses

Processing was completed for 3,020 document requests during the period March 1969 through February 1970 of which 2,305 (76%) were for hard copy and 715 (24%) were for microfiche. Not all of the requests processed were received during the period of the study. Two hundred eighteen requests had been received in the two months preceeding the time period, leaving 2,802 requests which were received and fully processed during the year. An additional 96 requests were received but not completely processed until after the 12 months period. The distribution between hard copy and microfiche of all requests received and/or processed is given below:

	Hard Copy	Microfiche	Total
Requests received prior to study year and processed during study year	147	71	218
Requests received and processed during study year	2,158	644	2,802
Requests received during study year and processed after study year	95	1	96
TOTALS	2,400	716	3,116

The data which follow pertain only to those document requests whose processing was completed during the experimental time period, i.e. the 3,020 document requests of the first two groups listed above.

The 3,020 document requests were not each a different document. Actually only 2,457 unique documents were requested by the KASC clientele; a ratio of 1.2 copies to each document requested. This ratio exists for hard copy and microfiche as well as for all document requests. The quantities of requests versus the numbers of unique documents on a monthly basis is displayed in Table 1.

Table 1. Document Request Responses by Medium by Month.

Month	Hard Copy		Microfiche		Total	
	Total Requests	Unique Documents	Total Requests	Unique Documents	Total Requests	Unique Documents
Mar 69	262	233	125	120	387	351
Apr	222	222	46	45	268	267
May	242	232	90	86	332	312
Jun	169	159	76	66	246	221
Jul	184	173	80	80	264	249
Aug	227	207	16	16	243	222
Sep	181	174	48	48	229	212
Oct	153	143	37	37	190	173
Nov	198	187	31	31	229	214
Dec	176	163	63	54	239	211
Jan 70	116	105	37	33	153	136
Feb	174	162	66	65	239	227
All Month	2,305	1,983	715	609	3,020	2,457

The low quantity of duplicate document requests received by the KASC from its clientele prevents the generation or acquisition of a stock of document copies from which clientele demands could be supplied as received. The copy to be supplied must either be generated by the KASC or obtained from other sources in order to avoid high storage costs. In addition the low quantity of unique documents requested, 2,457 out of a possible 193,249, demands that where the KASC maintain document copy in its holdings for reproduction upon demand that copy must consume the smallest storage space possible. It is mandatory then that in supplying its clientele with document copy the documents in its holdings must be on a medium of storage, such as microfiche, which consumes the least amount of space and yet permits rapid access and updating.

Table 2 provides the mean quantity of document request responses by month to organizational clients. For the year, the 41.36 responses to the average document client exceeds the 39.6 requests received from him by 1.76. This is a result of the larger quantity of requests (225) received prior to the study year but processed during the year than the quantity of requests (96) received during the study year but processed after its completion. The difference between these two groups is 129 items or an average of 1.76 per client.

Of the 3,020 document request responses during the year, approximately 17% were unassociated with KASC search services (Table 3). With an average of 250 responses per month to clients, this means that approximately 42 of them have either bypassed the KASC procedures for col-

Table 2. Mean Document Request Responses per Client by Month.

Month	Hard Copy		Microfiche		Total	
	Mean Responses	No. of Clients	Mean Responses	No. of Clients	Mean Responses	No. of Clients
Mar 69	7.71	34	10.42	12	10.46	37
Apr	8.22	27	3.55	13	9.24	29
May	7.33	33	11.25	8	9.22	36
Jun	5.67	30	6.91	11	7.45	33
Jul	5.41	34	8.89	9	7.14	37
Aug	6.31	36	2.67	6	6.39	38
Sep	6.46	28	4.80	10	7.16	32
Oct	5.28	29	3.36	11	5.59	34
Nov	7.07	28	5.17	6	7.63	30
Dec	5.87	30	10.50	6	7.97	30
Jan 70	4.83	24	3.36	11	5.88	26
Feb	6.96	25	9.43	7	8.89	27
All Months	33.41	69	29.79	24	41.36	73

lecting feedback data from its clients on its information systems or that the processing clerk was unable to relate the document request to any search service provided to the client. It is obvious from Table 3 that the monthly quantity of unassociated requests decreased from the first to the last month of the year of study which reflects increased control of the document processing procedures.

Table 3. Document Request Responses by Search Service by Month.

Month	Search Service Unidentified		Total	Search Service Identified		Total	Grand Total
	Hard Copy	Mirco-fiche		Hard Copy	Micro-fiche		
Mar 69	113	4	117	149	121	270	387
Apr	81	4	85	141	42	183	268
May	55	19	74	187	71	258	332
Jun	32	4	36	138	72	210	246
Jul	35	2	37	149	78	227	264
Aug	47	1	48	180	15	195	243
Sep	26	2	28	155	46	201	229
Oct	28	3	31	125	34	159	190
Nov	31	0	31	167	31	198	229
Dec	14	0	14	162	63	225	239
Jan 70	5	3	8	111	34	145	153
Feb	13	0	13	161	66	227	240
All Months	480	42	522	1,825	673	2,498	3,020

Response was made during the year to 326 unique profile users whose document requests were associated with search service. Tables 4 through 7 provide the mean request responses by month for unique profile users and for Types II, III, and IV search services of the KASC. The average profile user requesting document copy received 7.66 responses from the KASC as opposed to the 4.60 document requests submitted by the average profile user receiving search service (see page 4-15). The difference,

Table 4. Mean Document Request Responses Per Identified Search Service by Month.

Month	Hard Copy		Microfiche		Total	
	Mean Responses	No. of Profiles	Mean Responses	No. of Profiles	Mean Responses	No. of Profiles
Mar 69	1.80	83	2.63	46	2.25	120
Apr	2.20	64	1.35	31	2.20	83
May	2.20	85	2.73	26	2.46	105
Jun	1.92	72	3.43	21	2.39	88
Jul	2.04	73	3.00	26	2.44	93
Aug	1.98	91	2.14	7	2.05	95
Sep	3.10	50	2.30	20	3.14	64
Oct	2.72	46	1.89	18	2.61	61
Nov	2.53	66	3.10	10	2.64	75
Dec	2.57	63	4.85	13	3.17	71
Jan 70	2.09	53	2.27	15	3.26	64
Feb	2.52	64	5.08	13	3.20	71
All Months	6.59	277	6.35	106	7.66	326

of course, is due to the different populations used for determining the mean responses and the mean requests. The earlier mean determinations based on the total profile users receiving service were made to predict the document requirements of a clientele based on the profiles being served. The mean document request responses by the KASC as presented in Tables 4 through 7 were made in order to contrast the recipient of search services with the recipient of document services. The propor-

Table 5. Mean Document Request Responses per Type II Service by Month.

Month	Hard Copy		Microfiche		Total	
	Mean Responses	No. of Profiles	Mean Responses	No. of Profiles	Mean Responses	No. of Profiles
Mar 69	1.63	8	3.20	10	2.65	17
Apr	3.29	17	3.00	3	1.00	20
May	2.04	25	1.66	3	2.00	28
Jun	1.50	14	3.20	5	1.95	19
Jul	1.64	17	2.71	7	1.95	24
Aug	1.60	23	4.00	1	1.82	23
Sep	3.61	18	1.00	4	3.13	22
Oct	1.37	16	2.12	8	1.62	24
Nov	1.58	17	4.80	5	2.31	22
Dec	2.21	14	3.00	1	2.26	15
Jan 70	2.14	14	3.00	3	2.16	18
Feb	1.25	20	2.66	6	1.64	25
All Months	5.65	72	9.29	17	6.35	86

tion of KASC clientele profile users who also required document service from the KASC is as follows:

	All Profile Users	Profile Users Submitting Document Requests	% Profile Users Requesting Documents
Type II profile users	171	86	50
Type III profile users	368	230	63
Type IV	17	10	59
All Users	556	326	59

Table 6. Mean Document Request Responses per Type III Service by Month.

Month	Hard Copy		Microfiche		Total	
	Mean Responses	No. of Profiles	Mean Responses	No. of Profiles	No. of Responses	No. of Profiles
Mar 69	1.78	73	2.52	34	2.13	100
Apr	1.90	43	1.57	28	1.86	60
May	2.31	58	2.95	20	2.64	73
Jun	2.01	56	2.60	15	2.30	66
Jul	2.09	52	3.10	19	2.54	66
Aug	2.12	64	1.57	7	2.16	68
Sep	2.76	30	2.47	17	3.12	40
Oct	3.18	27	1.77	9	3.09	33
Nov	2.86	46	1.40	5	2.78	50
Dec	2.61	47	2.45	11	2.83	53
Jan 70	2.11	35	2.40	10	2.33	42
Feb	3.09	43	7.50	6	4.04	44
All Months	6.80	196	5.24	85	6.32	230

The smaller proportion of Type II users who request document copies easily accounts for the lower average quantity of document requests per profile served than for the other services whether comparing C/A only, retrospective only, or a combination of both (see page 4-17). In light of this, it is somewhat surprising that on the basis of profiles served Type II C/A only service had a higher proportion of abstracts resulting in document requests than did Type III C/A only service. The Type II profile user receives on the average fewer abstracts than the other two types and

Table 7. Mean Document Request Responses per Type IV Service by Month.

Month	Hard Copy		Microfiche		Total	
	Means Responses	No. of Profiles	Mean Responses	No. of Profiles	Mean Responses	No. of Profiles
Mar 69	3.00	2	1.5	2	3.00	3
Apr	1.00	3	.0	0	1.00	3
May	1.00	2	3.50	2	2.25	4
Jun	2.00	2	17.00	1	7.21	3
Jul	4.00	3	.00	0	4.00	3
Aug	1.50	4	.00	0	1.50	4
Sep	3.50	2	.00	0	3.50	2
Oct	5.66	3	1.00	1	4.50	4
Nov	2.66	3	.00	0	2.66	3
Dec	4.00	2	33.00	1	20.50	2
Jan 70	1.75	4	1.00	1	2.00	4
Feb	2.00	2	5.00	1	4.50	2
All Months	9.33	9	16.75	4	11.62	10

does not have the benefit of a subject specialist to direct him to the most relevant items or to enrich the abstracts which he receives by eliminating nonrelevant citations. Yet, he requests document copy from the abstracts he receives less frequently than the Type III or IV user but still selects a larger portion of his abstracts for full document copy than does the Type III profile user.

It is unlikely that the Type II profile user has a more diligent personality than the Type III user. One or both of the following is the probable explanation:

- KASC clients prefer its Type II service for profiles for which a small quantity of relevant items are known to exist in the NASA information resource. This probability would result in a smaller proportion of Type II users having profiles for which relevant search output is to be expected than of Type III users having similar profiles. As a natural result, the total relevant output for Type II service would be concentrated in a smaller number of users.

- The additional number of abstracts which a Type III C/A user receives over the Type II C/A user, 42% more items, deters the Type III user from reading with care abstracts beyond those identified for him by a subject specialist, 23% of those forwarded. The "end of the tunnel" is more readily seen by enough Type II users who, proceeding to evaluate each abstract received with equanimity, ultimately request documents for a larger average portion of the abstracts they receive than do all Type III users combined.

Where average number of document requests and "efficiency" were indirectly related for Types II and III C/A only service, the two factors for Retrospective only service are directly related. It is tempting to explain the reversed relationship using our second probability just described and state that both service types, receiving on the average 276.7 and 340.4 abstracts, respectively, had difficulty seeing the "end of the tunnel." If this be true, then the higher average document requests from Type III profile users can be construed to be a combined effect of the greater average number of abstracts received and the assistance of the subject specialist in identifying relevant document abstracts.

A similar explanation can be given for the greater average document requests and "efficiency" of all C/A service as opposed to Retrospective

service. The fact that the C/A user received his search output at periodic intervals during an average 8.9 months allowed him a series of short "tunnels" rather than the relatively long one of the retrospective user. As a consequence, the average profile requiring retrospective service resulted in fewer requests for documents regardless of its service type than did the average profile requiring current awareness service. This is detailed on a monthly basis in Table 8 which is further broken down by hard copy and microfiche document requests in Tables 9 and 10.

Table 8. Mean Document Request Responses per Profile by Search Service.

Month	Retrospective Searches		Current Awareness Searches		Total	
	Mean Responses	No. of Profiles	Mean Responses	No. of Profiles	Mean Responses	No. of Profiles
Mar 69	2.0	15	2.2	109	2.2	124
Apr	3.7	9	2.0	75	2.3	81
May	4.9	14	2.1	92	2.5	103
Jun	2.6	11	2.0	89	2.3	91
Jul	3.4	11	2.2	86	2.5	92
Aug	1.9	11	2.1	84	2.1	94
Sep	3.7	12	2.9	54	3.2	63
Oct	6.0	9	2.0	53	2.7	59
Nov	1.8	5	2.7	70	2.8	72
Dec	2.0	4	3.2	67	3.2	71
Jan 70	4.0	4	2.2	60	2.3	63
Feb	5.6	5	3.1	64	3.4	66
All Months	6.7	57	7.2	294	7.7	326

Table 9. Mean Hard Copy Document Request Responses per Profile by Search Service.

Month	Retrospective Searches		Current Awareness Searches	
	Mean Responses	No. of Profiles	Mean Responses	No. of Profiles
Mar 69	1.0	14	1.9	73
Apr	3.6	7	2.0	58
May	3.5	10	2.0	76
Jun	2.6	7	1.9	62
Jul	2.5	10	2.0	62
Aug	1.7	10	2.1	76
Sep	3.8	9	2.9	42
Oct	6.9	7	1.9	40
Nov	1.8	5	2.5	62
Dec	2.0	4	2.6	60
Jan 70	2.3	3	2.1	50
Feb	3.8	5	2.4	59
All Months	5.2	50	6.1	257

It has been mentioned that 218 of the total 3,020 document requests whose processing was completed during the year of the study were actually received prior to the beginning of the year of the study, March 1969. It is to be expected that these requests were for documents announced by NASA in STAR prior to March 1969. However, of the remaining 2,802 requests which were received and processed during the year, 1,123 were also for requests for documents announced prior to March 1969, not

Table 10. Mean Microfiche Document Request Responses per Profile by Search Service.

Month	Retrospective Searches		Current Awareness Searches	
	Mean Responses	No. of Profiles	Mean Responses	No. of Profiles
Mar 69	5.7	3	2.4	44
Apr	2.7	3	1.8	19
May	4.7	7	2.0	19
Jun	2.8	4	3.4	18
Jul	4.0	3	2.5	26
Aug	4.0	1	1.0	15
Sep	4.3	3	1.9	17
Oct	2.0	3	1.8	16
Nov	.0	0	3.4	9
Dec	.0	0	4.8	13
Jan 70	9.0	1	1.8	14
Feb	3.0	3	6.3	9
All Months	5.8	21	6.7	82

all of which resulted from retrospective search service as shown below:

	C/A Service		Retrospective Service		Unrelated to Service		Total	
		%		%		%		%
Requests received prior to study year for documents announced prior to study year	102	4.8	29	7.6	87	16.7	218	7.2

	C/A Service	%	Retrospective Service	%	Unrelated to Service	%	Total	%
Requests received during study year for documents announced prior to study year	384	18.1	334	87.9	405	77.6	1,123	37.2
Requests received during study year for documents announced during study year	1,632	77.1	17	4.5	30	5.7	1,679	55.6
TOTALS	2,118	100.0	380	100.0	522	100.0	3,020	100.0

It can be seen that during any one year of service the KAS Center can be expected to be called upon for documents announced in previous years even if no retrospective service were provided. At least one month's lag is expected by C/A users between time of a document's announcement and receipt of their requests for copies. But it appears that as great a quantity of document copies announced in previous years will have been requested by C/A users as by retrospective users! Because a large portion of requests which could not be associated with any of the KASC search services were also for documents announced prior to the year of the study it can not be expected that all of these were probably associated with C/A service, however. It is more likely that they were in reality associated with retrospective service and represent a piece-meal attack by the user upon his search results. Such an approach to evaluation of abstracts can easily lead to a disassociation of the abstract from the search identification so that by the time a document is requested the profile user is either no longer certain of the circumstances which lead him to the abstract or does not feel an obligation to inform the KASC.

Supporting the contention that the document requests unassociated with search services were probably a result of retrospective service is the study of time lapse between receipt of an abstract by a C/A profile user and receipt of his document request by the KASC as presented in Table 11. For the year's service, 50% of the C/A users requested full document copy within 2.6 months after receiving its abstract. It is unlikely that the C/A document requestors whose search services were unknown would have followed another pattern as drastically different as would be required for 77.6% of their requests to have been for document announced before March 1969.

Summary

During the year March 1969 through February 1970, the KASC responded to 3,020 requests from its clientele for copies of documents from the NASA information resource as announced by NASA in STAR from 1962 through February 1970. The total requests were for 2,457 unique documents thus representing 1.2 requests per document item. Fifty-nine per cent of all profile users served requested documents for an average of 7.7 requests each. Clients requesting documents for whom the profile search service could be identified submitted a larger number of orders for documents brought to their attention by means of C/A service than by means of retrospective service. However, a study of the pattern of time lapse between month of abstract receipt by the profile user and month of receipt of document request by the KASC suggests that those document requests which could not be associated with search services by the KASC are predominately a result of retrospective search service.

Table 11. Months Lapse between Receipt of Current Awareness Citation by Client and Month Document Request Received by KASC.

Months Lapse	Month Request Received												All Months
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	
1	10	59	8	14	47	45	8	20	4	23	14	32	284
2	127	34	59	61	68	41	62	44	40	74	65	60	735
3	47	22	46	38	33	30	39	29	104	62		20	470
4	15	28	42	36	20	19	18	4	30	16	22	31	281
5	23	4	11	8	8	15	8	3	11	8	17	15	131
6	13		12	6	5	16	9	2		10	2	4	79
7	4	1	5	3		4	10	3		8		4	42
8		1	5	8	5	3				6	1	1	30
9		1	2	4	4	1				7			19
10				1						1	1	5	8
11										2	5		7
12	1												1
15											2		2
16				1									1
17				1									1
28												2	2
33												5	5
34												5	5
35												1	1
44												5	5
45												1	1
46												6	6
47												2	2
Totals	240	150	190	181	190	174	154	105	189	217	129	199	2118
Mean	2.9	2.3	3.4	3.5	2.7	3.0	3.1	2.7	3.0	3.3	3.3	7.9	3.5
Median	2.4	2.0	3.1	2.9	2.2	2.5	2.7	2.2	3.0	2.7	2.3	2.9	2.6

The year of document service covered by the experiment indicates the following:

- The low quantity of duplicate document requests by KASC clients does not warrant the expense of stocking multiple copies of NASA information resource documents for off-the-shelf distribution.
- The low quantity of requests for unique documents within the NASA information resource does not warrant the storage of single copies in hard copy for reproduction by the KASC upon demand. No method of predicting the clientele preference for documents recommends that single copies be maintained by the KASC on a medium which consumes the least storage space and still allows rapid access and file updating.
- Previous indications that C/A service will result in more document demands than retrospective service by the KASC clientele may be erroneous. The number of requests received unassociated with search service, previously prorated over all profiles served, are in all probability associated with retrospective service. The effect on total document requests for all search services, however, is not changed.

Document Reproduction

Of the 3,020 document requests responded to during the year of the study, 2,739 (90.7%) resulted in document copy being forwarded to the requesting client and 281 (9.3%) resulted in a rejection of the client's request. Two hundred seventeen (77.2%) of the rejected requests were for hard copy and the remaining 64 (22.8%) were for microfiche copy. Rejection of clients' requests was discussed earlier in Section III. As stated there, a client's request for microfiche is rejected when the document is not available to the KASC on that medium. Almost invariably, the client returns his request with a change to hard copy. Rejected hard copy requests, however, result from a client's second thoughts about his needs for personal copies of documents. When cost of the requested copy approaches

$10, a client is queried to determine if he is aware of the cost. Except where the client is a librarian who is increasing the holdings of his library, the client almost invariably cancels the request.

The 64 rejected microfiche requests represent, then, a duplication in the total 3,020 request responses by the KASC, assuming that each rejected request was returned as a hard copy request. The total responses is decreased to 2,956 of which 217 or 7.3% were rejected. The remaining 2,739 requests were filled in one of two ways: through document copy reproduced by the KASC or through document copy obtained by the KASC. Table 12 presents the quantities of document copies supplied by each of these methods for all document requests, while Tables 13 and 14 provide the same information for hard copy requests and microfiche requests, respectively.

Of the 2,739 document copies supplied to KASC clients, 612 (22.3%) were obtained from outside the KASC and provided directly to the clients while 2,127 (77.7%) were reproduced within the KASC offices and the new copy supplied to the client. The distribution of copies supplied by the two modes of response and by the medium of the document provided are given below:

	Copy Obtained	Copy Reproduced	Totals
Hard Copy	552	1,536	2,088
Microfiche	60	591	651
TOTALS	612	2,127	2,739

Table 12. All Document Requests Processed by Mode of Response

Month	Document Copy Obtained by KASC Supplied to Client	Document Copy Reproduced by KASC and Supplied to Client	Client's Document Request Rejected by KASC	Total
Mar 69	86	275	26	387
Apr	47	196	25	268
May	59	247	26	332
Jun	49	160	37	246
Jul	39	189	36	264
Aug	101	125	17	243
Sep	44	168	17	229
Oct	50	127	13	190
Nov	25	173	31	229
Dec	43	172	24	239
Jan 70	12	127	14	153
Feb	57	168	15	240
All Months	612	2,127	281	3,020

The KASC relied upon sources outside its own resource for hard copy for the following reasons:

- The document copy was obtainable for the KASC client at less cost than it could be reproduced by the KASC.
- The document copy was not available to the KASC for reproduction.

The KASC found that for the first condition 470 of the 552 hard copy requests applied. The document copy was obtained from the Clearinghouse for Federal Scientific and Technical Information (CFSTI) whose pricing

Table 13. Hard Copy Document Requests Processed by Mode of Response

Month	Document Copy Obtained by KASC Supplied to Client	Document Copy Reproduced by KASC and Supplied to Client	Client's Document Request Rejected by KASC	Total
Mar 69	56	184	22	262
Apr	36	169	17	222
May	58	161	23	242
Jun	47	93	30	170
Jul	35	125	24	184
Aug	100	110	17	227
Sep	41	128	12	181
Oct	43	97	13	153
Nov	25	149	24	198
Dec	43	115	18	176
Jan 70	12	95	9	116
Feb	56	110	8	174
All Months	556	1,536	217	2,305

policy becomes competative with the KASC reproduction charges of $.05 per page for documents longer than 60 pages. The 470 document copies represent 22.5% of the hard copy items supplied by the KASC to its clientele during the year. On the basis of 1.2 requests per unique document, these requests represent 392 individual documents constituting 16% of the total 2,457 unique items requested by KASC clients during the year.

Table 14. Microfiche Document Requests Processed by Mode of Response

Month	Document Copy Obtained by KASC Supplied to Client	Document Copy Reproduced by KASC and Supplied to Client	Client's Document Request Rejected by KASC	Total
Mar 69	30	91	4	125
Apr	11	27	8	46
May	1	86	3	90
Jun	2	67	7	76
Jul	4	64	12	80
Aug	1	15	0	16
Sep	3	40	5	48
Oct	7	30	0	37
Nov	0	24	7	31
Dec	0	57	6	63
Jan 70	0	30	5	37
Feb	1	56	7	66
All Months	60	591	64	715

The remaining 82 hard copy items obtained outside the KASC apply to the second condition, above. This group, representing 3.9% of the hard copy items supplied by the KASC during the year, represents 2.8% of the total unique items requested by KASC clients.

Outside sources were utilized for 60 document requests for microfiche or microfilm because the documents, while available on the stated medium, were not available to the KASC from NASA. The 60 document copies re-

present 9.2% of the microfilm items supplied but only 2.0% of the total unique documents requested by KASC clients during the year.

For the 2,739 document copies supplied, three categories of document source were utilized to obtain the copy either for reproduction or direct shipment to the client. The three categories were:

- NASA by standard distribution
- Sellers of document copy
- Suppliers of gratis document copy (including NASA by special requisition).

Tables 15, 16, and 17 describe on a monthly basis the quantities of documents obtained from each of these sources for all documents supplied, for hard copy documents supplied, and for microfiche copies, respectively.

For all document copy, 77.4% of the items supplied were obtainable from NASA on standard distribution. For hard copy alone, the standard distribution source was slightly less dependable (73.2%) but for microfiche copy it provided 91.0% of the required documents. The 22.6% of the documents supplied which were dependent upon other category sources relied more heavily upon sources willing to sell document copy rather than to provide free copy. This was true of hard copy items supplied but the reverse was true for microfiche items supplied to the KASC clientele. The utilization of the CFSTI as a source of hard copy exceeding 60 pages in length accounts for most of the hard copy dependency upon the seller (26.1% of the hard copy supplied); the need to supplement the NASA standard distribution of microfiche with speical requisitions accounts

Table 15. Origin of Document Copy Used for Filling All Document Requests.

Month	Supplied by NASA on Standard Distribution	Purchased by KASC from Supplier	Supplied to KASC at no Cost*	Total
Mar 69	274	50	37	361
Apr	196	36	11	243
May	247	52	7	306
Jun	160	48	1	209
Jul	190	36	2	228
Aug	117	109	0	226
Sep	167	44	1	212
Oct	127	46	4	177
Nov	173	25	0	198
Dec	173	42	0	215
Jan 70	127	12	0	139
Feb	169	56	0	225
All Months	2,120	556	63	2,739

*Includes special requisitions of documents from NASA.

for most of the microfiche dependency upon the supplier of gratis copy to the KASC (7.5% of the microfiche copy supplied). The quantities of items obtained from the three source categories by medium of document copy supplied is summarized below:

	Standard Distribution	Purchase	Free	Total
Hard Copy	1,528	546	14	2,088
Microfiche	592	10	49	651
TOTALS	2,120	556	63	2,739

Table 16. Origin of Document Copy Used for Filling Hard Copy Document Requests.

Month	Supplied by NASA on Standard Distribution	Purchased by KASC from Supplier	Supplied to KASC at no Cost*	Total
Mar 69	183	50	7	240
Apr	169	36	0	205
May	161	51	7	219
Jun	93	47	0	140
Jul	126	34	0	160
Aug	102	108	0	210
Sep	127	42	0	169
Oct	97	43	0	140
Nov	149	25	0	174
Dec	116	42	0	158
Jan 70	95	12	0	107
Feb	110	56	0	166
All Months	1,528	546	14	2,088

*Includes special requisitions of document from NASA.

Organizations utilized as sources and falling within one or more of the above three source categories are listed below with the proportion of documents supplied by the KASC to its clientele which was originally derived from the organization.

Organization	% Documents Supplied
Air Force Machinability Data Center, Cincinatti, Ohio	0.1
Aerospace Research Applications Center, Indiana University	3.8

Table 17. Origin of Document Copy Used for Filling Microfiche Document Requests.

Month	Supplied by NASA on Standard Distribution	Purchased by KASC from Supplier	Supplied to KASC at no Cost *	Total
Mar 69	91	0	30	121
Apr	27	0	11	38
May	86	1	0	87
Jun	67	1	1	69
Jul	64	2	2	68
Aug	15	1	0	16
Sep	40	2	1	43
Oct	30	3	4	37
Nov	24	0	0	24
Dec	57	0	0	57
Jan 70	32	0	0	32
Feb	59	0	0	59
All Months	592	10	49	651

*Includes special requisitions of document from NASA.

Organization	% Documents Supplied
Clearinghouse for Federal Scientific and Technical Information	17.2
National Aeronautics and Space Administration, standard distribution	73.5
National Aeronautics and Space Administration, special requisition	2.2
National Lending Library, England	1.1
National Translation Center, Chicago	.0*
Technical Information Service, American Institute of Aeronautics and Astronautics	.0*

* Less than .1%

Organization	% Documents Supplied
University Microfilms, Ann Arbor, Michigan	1.8
U. S. Bureau of Mines, Pittsburgh	.0*
Miscellaneous document publishers	.1

*Less than .1%

All eleven of the organizations were called upon for document copies in order for the KASC to provide hard copy service to its clientele but only four were required for the provision of microfiche copy service. The quantities of documents received from each organization for all documents supplied, for hard copy only, and for microfiche only are provided in Tables 18, 19, and 20, respectively.

The Aerospace Research Application Center was utilized as a hard copy document source after January 15, 1970, for documents which could be reproduced from microfiche using a reader/printer. During that month an experimental effort of the NASA Regional Dissemination Center Network was initiated whereby one of the NASA RDCs will provide hard copy of documents produced from microfiche for the remaining NASA RDCs upon their demand. The effect upon the KASC document service to its clientele was to cause the KASC to request of ARAC hard copy of those documents which it would have produced from microfiche copy using its ITEK 18-24RS reader/printer. The quantity of documents so obtained have been represented in previous data, Tables 12 and 13, as being reproduced by the KASC and in Tables 15 and 16 as having been obtained from NASA on standard distribution.

Table 18. Source of Document Copy Used for Filling All Document Requests.

	Source											
Month	1	2	3	4	5	6	7	8	9	10	11	Total
Mar 69	274	35	1	8	43							361
Apr	196	11		5	30	1						243
May	247	7		8	37		7					306
Jun	160	1		7	37		4					209
Jul	190	2		2	32		2					228
Aug	117			2	103		4					226
Sep	167	1		4	34		5		1			212
Oct	127	4		5	39		1	1				177
Nov	173			2	22		1					198
Dec	173				41		1					215
Jan 70	117				11					10	1	139
Feb	74			5	42	1	5			95	3	225
All Months	2015	61	1	48	471	2	30	1	1	105	4	2,739

Source Code:

1 Standard Distribution from NASA
2 Special Requisition from NASA
3 Technical Information Service, AIAA
4 University Microfilms
5 Clearinghouse for Federal Scientific and Technical
6 Publisher (commercial) of document
7 National Lending Library, England
8 National Translation Center, Chicago
9 U.S. Bureau of Mines, Pittsburgh
10 Areospace Research Applications Center, Indiana University
11 AF Machinability Data Center, Cincinatti

Table 19. Source of Document Copy Used for Filling Hard Document Requests.

	Source											
Month	1	2	3	4	5	6	7	8	9	10	11	Total
Mar 69	183	5	1	8	43							240
Apr	169	9		5	30	1						214
May	161	7		7	37		7					219
Jun	93			6	37		4					140
Jul	126				32		2					160
Aug	102			2	102		4					210
Sep	127			2	34		5		1			169
Oct	97			2	39		1	1				140
Nov	149			2	22		1					174
Dec	116				41		1					158
Jan 70	85				11					10	1	107
Feb	15			5	42	1	5			95	3	166
All Months	1423	21	1	39	470	2	30	1	1	105	4	2,097

Source Code:

1 Standard Distribution from NASA
2 Special Requisition from NASA
3 Technical Information Service, AIAA
4 University Microfilms
5 Clearinghouse for Federal Scientific and Technical Information
6 Publisher (commercial) of document
7 National Lending Library, England
8 National Translation Center, Chicago
9 U.S. Bureau of Mines, Pittsburgh
10 Aerospace Research Applications Center, Indiana University
11 AF Machinability Data Center, Cincinatti

Table 20. Source of Document Copy Used for Filling Microfiche Document Requests.

	Source											
Month	1	2	3	4	5	6	7	8	9	10	11	Total
Mar 69	91	30										121
Apr	27	2										29
May	86			1								87
Jun	67	1		1								69
Jul	64	2		2								68
Aug	15				1							16
Sep	40	1		2								43
Oct	30	4		3								37
Nov	24											24
Dec	57											57
Jan 70	32											32
Feb	59											59
All Months	592	40		9	1							642

Source Code:

1 Standard Distribution from NASA
2 Special Requisition from NASA
3 Technical Information Service, AIAA
4 University Microfilms
5 Clearinghouse for Federal Scientific and Technical Information
6 Publisher (commercial) of document
7 National Lending Library, England
8 National Translation Center, Chicago
9 U.S. Bureau of Mines, Pittsburgh
10 Aerospace Research Applications Center, Indiana University
11 AF Machinability Data Center, Cincinatti

While 100% of the KASC clients' requests for microfiche document copy was supplied through the reproduction of microfilm copy either by the KASC or some other source, 72.3% of the clients' requests for hard document copy was supplied to them through the exposure-developemnt processes of a microfiche printer. The remaining 27.6% of the hard copy requests, as previously mentioned, is accounted for primarily by the purchase of hard document copy from the CFSTI when the document exceeded 60 pages in length. The quantities of documents which were requested in hard copy or microfiche and for which hard copy or microfiche was used to supply the request are tabulated by month in Table 21.

Table 21. Medium of Document Copy Used for Filling Document Requests.

Month	Hard Copy	Microfiche			Total
	Hard Copy Requests Only	Hard Copy Requests	Microfiche Requests	Subtotal	
Mar 69	59	181	121	302	361
Apr	39	166	38	204	243
May	61	158	87	245	306
Jun	47	93	69	162	209
Jul	36	124	68	192	228
Aug	112	98	16	114	226
Sep	44	125	43	168	212
Oct	43	97	37	134	177
Nov	25	149	24	173	198
Dec	43	115	57	172	215
Jan 70	13	94	32	126	139
Feb	56	110	59	169	225
All Months	578	1,510	651	2,161	2,739

Summary

The KASC responded to 3,020 document requests of its clientele by supplying 2,739 (90.7%) document copies and rejecting 281 (9.3%) requests. Of the rejected requests, 217 were for hard copy whose cost to the client exceeded an amount which he was willing to pay and 64 were for microfiche copy when the document was not available on that medium.

Of the 2,739 document copies supplied, 2,127 (77.7%) were reproduced by the KASC and 612 (20.3%) were obtained from other suppliers and submitted to the KASC clients. Five hundred fifty-two of the latter group were requests for hard copy of which 470 were obtained from the CFSTI. Documents in excess of 60 pages were purchased from the CFSTI rather than produce them within the KASC in order to obtain document copy at the lowest possible cost for the Center's clientele. The 470 document copies represent approximately 392 unique documents or 16% of those required in order to fulfill the demands of the KASC clientele during the year of the study. The remaining 82 document copies obtained from other suppliers represent 2.8% of the total unique documents.

The document copy used for reproduction or for direct supply to KASC clients was predominantly obtained from NASA on standard distribution (77.4%). The remaining required copies were either purchased (20.3%) or obtained free of charge (2.3%). Eleven organizations including NASA three times, once for standard distribution, once for special requisitions and once as ARAC, were used as sources of the needed document copy.

The next largest organizational source after NASA (79.5%) was CFSTI (17.2%) with the remaining 3.3% supplied by seven other organizations. The quantity obtained from NASA on special requisition (2.2%) represents the dependency of the KASC, in serving its clientele, upon NASA for supplementing its initial standard distribution. The hard copy document copies supplied to KASC clients were for the major part (72.3%) reproduced from microfiche using a reader/printer while all microfilm document copies supplied were reproduced from microfilm.

The data collected during the year of document reproduction indicate that:

- The KASC cannot or is not required by its clientele to comply with 9% of the document requests which it submits.
- The KASC should have in its holdings a minimum of 72% of the documents required by its clientele. During the year's service the KASC received 70% of the required documents by standard distribution from NASA and found it necessary to submit requests for an additional 2% of the required documents in order to comply with its clientele requirements.
- The KASC finds that 16% of its clients' document requirements are more economically obtained for the client from the CFSTI than by reproduction by the KASC.
- Approximately 3% of the documents required by KASC clients will have to be purchased from commercial sources.

Equipment Selected and Utilized

An in-house capability for the production of both hard copy and microfiche copy was required by the KAS Center in order to provide document service to its clientele. For this purpose, equipment was evaluated which would permit the production of hard copy from microfiche and the duplication of microfiche. The criteria used for comparison of com-

mercially available machines were the following:

1. Cost of the equipment
2. Economy of production
3. Speed of production
4. Ease of operation
5. Ease of installation
6. Ease and availability of maintenance services
7. Acceptability of end product

In comparing different manufacturers' models of equipment for the production of hard copy from microfiche, it was found that sufficient variation occurred within and between available machines to cause a ranking of them to be highly subjective. This was particularly true for the criterion "ease of operation." A final selection was made by the KASC of equipment which was on the market in July 1968 resulting in the purchase of an ITEK 18-24RS reader/printer. This machine is used to enlarge and expose simultaneously two frames of a microfiche document on an eleven inch roll of light sensitive paper which is then automatically chopped at fourteen and a half inches. The 11 x 14½ inches sheet is then processed by the equipment for development of the enlarged document page images and passed through a drier. The pages of the newly produced hard copy document are collated by hand and bound with plastic elements using a GBC Binder.

In comparing different manufacturers' models of equipment for the duplication of microfiche, they were found to be so similar that differentiation had to be made almost entirely upon cost of the equipment and acceptability of end product. The end product of different machines is affected by the process used for insuring even contact between the microfiche to be dup-

licated and the film. Machines which rely upon pressure rollers to insure this contact can be subject to the occurrence of slippage resulting in a blurred reproduction. A vacuum imposed contact more frequently provides the necessary eveness of contact for a usuable end product.

In January 1969, the KASC selected for purchase the Atlantic Microfilm Corporation A-9 Printer and its companion D-22 Developer. The A-9 provides vacuum contact between the microfiche to be duplicated and a piece of diazo film and exposes the film under ultraviolet light. The exposed film must then be removed from the machine and passed through the D-22 Developer where the images of the duplicated microfiche are developed in an ammonium atmosphere. The reproduced copy requires no binding and is simply packaged in an envelope for delivery to the requestor.

In January 1970, the in-house capability of the KASC for the production of hard copy from microfiche was vicariously increased by the utilization of the services of its sister regional dissemination center, ARAC, located at Indiana University. There document production from microfiche is accomplished by use of a Xerox reader/printer. The end product is an 8½ x 11 inches page containing only one frame of the original microfiche. While the end product is a more desirable size, illustrations which may occur within a document are not well reproduced. To overcome this draw back, document copies obtained from ARAC are collated and illegible graphics or illustrations are replaced with copy produced using the KASC's ITEK 18-24RS.

The KASC utilizes for its own purposes a Xerox 3600I copier in the production of hard copy from hard copy. Use of this same machine is made in the provision of hard copy document service to its clientele when the KASC copy is already hard copy.

A summarization of the year's experience using these four pieces of equipment for the provision of KASC clients with document copy is provided in Table 22. For all document copy provided, 23% of the items did not require the use of any reproduction equipment while 77% of the items required the use of one of the machines. The proportions of the document copies for which reproduction equipment was necessary is given below by machine used:

	Hard Copy	Microfiche	All Copy
No Equipment	26.9%	10.3%	23.0%
Xerox 3600I Copier	.8	-	.6
Xerox Microfilm Reader/Printer	5.0	-	3.8
ITEK 18-24RS Reader/Printer	67.3	-	51.3
Atlantic Microfilm A-9/D-22	-	89.7	21.3
Totals	100.0%	100.0%	100.0%

The importance of the capability of producing hard copy by the KASC for the provision of hard copy service to its clientele is underscored by the low percentage (26.9%) of hard copy requiring no equipment. Essentially, this represents that portion of documents which either the KASC could not obtain through NASA or could obtain at a lower cost to the

client through the CFSTI. The extremely small portion (.8%) of the hard copy documents which utilized a copying machine is indicative of the absolute need on the part of the KASC for equipment which can produce hard copy from microfiche copy. The fact that more than one fifth (23.8%) of all document copy supplied was demanded on microfiche does not detract from the importance of this capability to the KASC. The majority of the documents supplied to its clientele (55.1%) were obtained at the lowest possible cost to the clientele through the in-house reproduction of hard copy from microfiche.

Regardless of the equipment used or not used for providing document copy to its clientele the mean number of pages per hard copy document was 52. Half of the documents supplied, however, were under 27 pages in length. It is because of the shorter length that 72.3% of the hard copy items supplied were obtained for the client more economically by local production than from a centralized source. The total quantity of pages of hard copy and sheets of microfiche provided to KASC clients during the year is presented by month in Table 23.

Summary

Document service provided by the KASC to its clientele during the period March 1969 through February 1970 required the use of four different pieces of equipment. One machine, a Xerox 3600I, was used for the production of hard copy from hard copy and accounted for only .6% of all documents supplied or .8% of the hard copy items supplied. Two machines, a Xerox reader/printer and an ITEK reader/printer, were used for the

Table 22. Reproduction Equipment Utilized for Filling Document Requests.

Month	Equipment							Total
	1			2	3	4	5	
	a	b	Subtotal					
Mar 69	56	30	86	4		180	91	361
Apr	36	11	47	3		166	27	243
May	58	1	59	3		158	86	306
Jun	47	2	49	0		93	67	209
Jul	35	10	45	1		124	58	228
Aug	109	1	110	3		98	15	226
Sep	42	4	46	2		125	39	212
Oct	43	7	50	0		97	30	177
Nov	25	0	25	0		149	24	198
Dec	43	0	43	0		115	57	215
Jan 70	12	0	12	1	10	84	32	139
Feb	56	1	57	0	95	15	58	225
All Months	562	67	629	17	105	1,404	584	2,739

Equipment Code:
- 1a No equipment (hard copy requests)
- 1b No equipment (microfiche requests)
- 2 Xerox 3600 Copier
- 3 Xerox Microfilm Reader/Printer
- 4 ITEK 18-24RS Reader/Printer
- 5 Atlantic Microfilm Printer and Developer

production of hard copy from microfiche and accounted for 55.1% of all documents supplied or 72.3% of the hard copy items supplied. One machine, an Atlantic Microfilm duplicator, was used for the production of microfiche copy from microfiche and accounted for 21.3% of all documents supplied or 89.7% of all microfiche copy items supplied. The remaining

Table 23. Size of Documents Supplied

Month	Hard Copy Requests			Microfiche Requests		
	Total Pages of Original Document	Average Pages per Document		Total Sheets of Original Document	Average Sheets per Document	
		Mean	Median		Mean	Median
Mar 69	12,718	53.0	27.5	185	1.6	1.3
Apr	9,058	44.2	22.6	67	1.8	1.2
May	8,743	39.9	27.3	142	1.6	1.2
Jun	7,780	55.2	27.9	114	1.7	1.4
Jul	7,416	46.4	28.5	101	1.6	1.3
Aug	14,378	72.3	52.3	19	1.2	1.1
Sep	8,168	48.6	23.1	58	1.4	1.2
Oct	6,855	49.0	25.0	37	1.0	1.2
Nov	7,941	45.4	24.9	34	1.4	1.2
Dec	9,479	60.0	27.0	88	1.5	1.4
Jan 70	5,038	46.6	25.8	60	1.9	1.6
Feb	10,624	64.0	32.8	82	1.4	1.1
All Months	108,198	52.0	26.7	987	1.5	1.2

document copies required by the KASC clientele (23.0%) were obtained from other sources and supplied directly to the client.

The short length, under 27 pages, of 50% of the hard copy items required by the KASC clientele permitted the Center to produce most of the hard copy locally at less expense to the clientele than to obtain it from a centralized source such as the CFSTI.

The experience of the KASC during the year indicates the following:

- The provision of document service to its clientele requires that the KASC possess a minimum of the different kinds of reproduction equipment: hard copy to hard copy, microfiche to hard copy, and microfiche to microfiche.
- Possession of the three different kinds of reproduction equipment will permit the KASC to supply locally approximately 72% of its clientele's requirements for documents contained within the NASA information resource.
- The provision of economical hard copy document service to its clientele demands the capability on the part of the KASC of production of hard copy from microfiche.

Timeliness of Service

The average number of days which lapse between the receipt of a clients' request for a document and the mailing of the KASC response to the request varies according to the mode of action which was required of the KASC. The average number of days required by the KASC for responding to all 3,020 document requests received during the period of the study is given below by the three possible modes of response:

	Copy Obtained	Copy Reproduced	Request Rejected
Hard Copy requests	53.8	13.5	54.3
Microfiche Copy requests	44.7	9.6	19.0
All requests	53.0	12.4	46.4

It can be seen from Tables 24, 25, and 26, which present the days lapse for all requests, hard copy requests, and microfiche requests, respectively, that the distribution of the days lapse for each request would construct a highly skewed curve. Of more significance, then, is the median number of days lapse which are summarized as follows:

	Copy Obtained	Copy Reproduced	Request Rejected
Hard Copy requests	41.7	10.3	16.8
Microfiche Copy requests	36.5	8.2	16.3
All requests	41.3	9.2	16.5

The total time lapse provided in these tables includes all processing, production, packing, and shipping time as well as intervening days of the weekend during which the KASC offices are closed. Despite the inclusion the total laspe of time, 50% of the microfiche document requests of the KASC clientele were not responded to within a week's time from when they were received. Microfiche copy production within the KASC is the quickest means of response available to the KASC for a client's document needs. If one day each is allowed for receipt and processing of the requests, another for reproduction of the requested document, and a fourth for packing and mailing of the document copy, a maximum possible of six days, allowing an intervening weekend, would seem reasonable. The requirement of 8.2 days

Table 24. Days Lapse in Processing all Document Requests by Mode of Response

Month	Document Copy Obtained by KASC Supplied to Client		Document Copy Reproduced by KASC and Supplied to Client		Client's Document Request Rejected by KASC	
	Mean	Median	Mean	Median	Mean	Median
Mar 69	52.5	39.8	11.1	7.9	18.0	10.1
Apr	47.1	45.0	13.9	11.5	26.9	20.4
May	64.3	52.0	16.1	14.0	61.1	26.5
Jun	62.0	57.0	10.5	8.8	85.1	28.1
Jul	64.7	61.0	15.0	9.6	27.4	13.5
Aug	79.7	69.0	10.0	8.1	40.6	14.1
Sep	57.0	39.5	13.2	8.0	15.7	10.4
Oct	55.2	36.5	7.8	7.1	224.9	160.5
Nov	42.1	33.7	9.2	8.8	21.9	9.5
Dec	40.4	29.0	11.1	9.1	23.1	17.9
Jan 70	29.2	20.5	15.7	15.0	70.7	22.0
Feb	33.6	23.3	10.7	9.0	20.3	13.5
All Months	53.0	41.3	12.4	9.2	46.4	16.5

for at least half the requests suggests that the document service system has one or more bottlenecks which account for a minimum cumulative quantity of two days delay. It can be assumed that these same factors affected hard copy produced locally, but until they have been recognized it cannot be assumed that they affected the provision of document copy, whether hard copy or microfiche, obtained from outside sources. If the delay occurs in the production process, the median time lapse of 41.3 days for

Table 25. Days Lapse in Processing Hard Copy Document Requests by Mode of Response

Month	Document Copy Obtained by KASC Supplied to Client		Document Copy Reproduced by KASC and Supplied to Client		Client's Document Request Rejected by KASC	
	Mean	Median	Mean	Median	Mean	Median
Mar 69	59.0	44.0	12.5	10.7	19.5	9.1
Apr	48.8	45.0	11.3	7.3	28.8	20.3
May	64.6	51.5	19.4	17.8	64.0	29.0
Jun	61.8	57.0	12.7	13.3	90.0	93.0
Jul	65.5	61.0	18.2	9.7	28.6	13.5
Aug	76.7	68.8	10.4	8.3	40.6	14.1
Sep	57.6	39.0	14.8	8.3	16.0	10.3
Oct	58.9	37.0	7.8	7.3	224.9	160.5
Nov	42.1	33.7	9.8	9.0	24.9	9.2
Dec	37.0	29.0	11.9	10.5	24.1	17.8
Jan 70	29.2	20.5	17.8	18.7	71.7	34.5
Feb	33.7	23.4	13.8	5.1	22.6	13.5
All Months	53.8	41.7	13.5	10.3	54.3	16.8

copy obtained elsewhere is valid; if not, then the median time lapse for these document copies should be lower by at least two days.

The above data remains useful for comparative purposes, however, and the desirability of local production of documents over dependency upon centralized document sources becomes obvious whether the required document be one in hard copy or on microfiche.

Table 26. Days Lapse in Processing Microfiche Document Requests by Mode of Response

Month	Document Copy Obtained by KASC Supplied to Client		Document Copy Reproduced by KASC and Supplied to Client		Client's Document Request Rejected by KASC	
	Mean	Median	Mean	Median	Mean	Median
Mar 69	40.2	32.7	8.4	7.8	9.2	10.0
Apr	41.7	36.3	30.2	11.5	22.7	20.5
May	52.0	52.0	10.1	9.8	38.6	26.0
Jun	66.5	65.0	7.4	7.7	25.4	21.2
Jul	58.5	60.0	8.1	7.3	20.2	18.0
Aug	210.0	210.0	7.2	7.2	.0	.0
Sep	49.6	50.0	8.2	7.9	15.0	13.0
Oct	32.7	44.7	7.5	4.3	.0	.0
Nov	.0	.0	5.5	5.2	12.2	11.2
Dec	.0	.0	9.4	8.3	20.0	18.5
Jan 70	.0	.0	9.8	9.1	12.6	9.0
Feb	9.0	9.0	9.9	9.1	17.1	10.5
All Months	44.7	36.5	9.6	8.2	19.0	16.3

Rejection of document requests by the KASC also require an unusually long time lapse. Suspected time delaying factors for provision of microfiche copies locally produced may also have affected this mode of response, but the total time lapse would still have exceeded the time required for local production of the document had it been available or desirable. Two different factors affect the time lapse which occurred for hard copy rejected requests and for microfiche rejected requests.

For the latter, the time required for response was increased by a zealous pursuit of knowledge that the required document was not in fact available on microfiche. A hesitancy existed on the part of the reproductions clerk to rely upon accuracy of the STAR Accession/Report Number Index as an indicator of microfiche availability. As a result, time consuming requisitions for microfiche copy were submitted to NASA to verify the Index after which the client almost invariably resubmitted the request for hard copy. Acceptance of the STAR Accession/Report Number Index as a valid tool in providing document service is now mandatory upon the clerical staff.

For hard copy rejected requests the time lapse includes the time spent in waiting upon a client to respond to the information that the document he requested will cost approximately $10.00. A failure on the part of a client to respond quickly with instructions to proceed with or to cancel the request may often cause an inordinate time lapse before cancellation of his request takes place. It is apparent in Table 25 that during the month of October 1969 an unusually long delay of this nature occurred. A change in the KASC document system has been instituted so that whether a document request is to be rejected because of an inability to comply with it or whether it is to be rejected on the instructions of the requesting client, the rejection action is taken immediately and the client's document order form is returned to him for resubmittal, with a change in the medium requested where necessary.

Summary

The time required by the KASC for responding to its clients' requests for document copy is considerably less when the document can be produced locally as opposed to the obtaining of the document from centralized sources. For 50% of the requests received less than 9.2 days were required when the document copy was produced in-house where less than 41.3 days were required when the document copy was obtained from an outside source.

The median time lapse for complying with microfiche document requirements which were produceable within the KASC has suggested that the document service system lacks the necessary controls for the absolute minimum time required to provide this service. Whether the control is lacking for document copy obtained outside the KASC has not yet been determined.

The median time lapse which occurred for the rejection of clients' requests for microfiche copy, where the KASC has an inability to comply, was discovered to be excessive because of an incorrect use of the reference tools required by the KASC in its document service system. The median time lapse for the rejection of clients' requests for hard copy was discovered to be false inasmuch as it included the time required for a client to respond to what was essentially a rejected request.

Based on its year of document service, the KASC has found that in providing document copy to its clientele from the NASA information resource that:

- The KASC clientele is more quickly supplied with a copy of the requested document, whether in hard copy or on microfiche, if the document can be reproduced by the KASC.

- Exactness of service can interfere with timeliness of service.

- Control of sequential functions required for document service is not necessarily maintained on a document by document basis resulting in the addition of a minimum of two unproductive days between receipt of a client's document request and the mailing to him of a response.

V. CONCLUSIONS AND RECOMMENDATIONS

The following conclusions can be made concerning the experience of the Knowledge Availability Systems Center in providing hard copy of documents contained in the NASA information resource to its clientele in the operation of a regional dissemination center:

- The search service provided by the KASC for its clientele directly affect the clientele's document requirements. In general, the type of service which provides a client with the greatest quantity of abstracts will result in the greatest quantity of document requests. However, KASC clients receiving approximately 75 abstracts supplied at periodic intervals requested documents for a larger percentage of the abstracts which they received than did clients receiving 130 abstracts or more whether supplied at periodic intervals or at a single instance.

- KASC clients do not require full document copy of all abstracts received through the Center's search services which they consider to be relative to their interests.

- KASC clients do not rely upon the KASC to provide every document from the NASA information resource which they may require.

- KASC clients require of the KASC only four to five per cent of the documents announced by NASA in STAR. In maintenance of a file of the NASA documents, such a low quantity warrants the sole use by the KASC of a medium consuming the least storage space and still permitting rapid access and file updating capability, such as microfiche.

- The KASC cannot or is not required by its clientele to comply with 9% of the document requests which it submits.

- Through local production, the KASC clientele is supplied with documents, whether in hard copy or on microfiche, in less than one-fourth the time required to obtain the document from a centralized source.

- Through the resources of NASA the KASC had the capability of producing locally 88% of the documents required by its clientele; however, 16% of the locally producable items were obtainable at less cost to its clientele through a centralized production agency such as the CFSTI.

- Approximately 3% of the documents required by KASC clients were obtainable only through commercial sources.

- The provision of economical hard copy document service to its clientele demands the capability on the part of the KASC of production of hard copy from microfiche. Provision of rapid microfiche copy document service to its clientele demands the capability on the part of the KASC for the reproduction of microfiche.

The provision of hard copy documents service at the local level is inextricably tied to a medium of document storage which consumes the least amount of space. Because no method is available for predicting the documents which will be required by a local clientele, a single copy from which hard copy can be produced must be retained at the local level for all documents which the clientele may possibly request even though only four to five per cent of them will be required. Storage of documents becomes necessary, therefore, even though they are never used. Needless to say, the most economical storage available must be utilized. Microfilm with ever diminishing reduction in image size is the current proposed solution to this problem which in the long run is not a solution. The certain passage of time creates a cumulation of documents which are never used but which continue to consume storage resources. To eliminate the local distribution level merely restores to an individual the problems he faces with centralized distribution, i.e. increased time lapse between the time of realized need and the receipt of the document. It also restores to the user and his organization the added work of payment for documents on a document-by-document basis rather than a monthly or quarterly single payment which becomes possible at the local level because of its willingness to risk the extension of credit to its client.

Even though the local level may continue to cumulate all possible documents required by its local clientele, the problem of time lapse in centralized distribution is not entirely avoided. Cost of documents is a factor to a client whether the document is produced locally or centrally. Mass document production reduces document costs but increases accounting costs if charges are based on a measure which results in a different price for each document produced. Local production by its lower quantity affords a smaller unit of measure for pricing purposes, such as number of pages per document, than can be utilized by the centralized agency. However, for approximately 16% of the hard copy documents which the local clientele may require, the per page measure exceeds at some point the first unit of measure used by the centralized production unit, such as every 500 pages, after which the price to the document user becomes cheaper through centralized production than local production. The lower document cost overrides the objectionable time lapse which is then increased through the intermediate role of the local production unit but without encountering the added work of single document payments on the part of the client.

The document storage problem of the local production agency is not solved simply by the elimination of mass document storage at the local level. Were the local level to be expected to store only those documents which its clientele may require, it must wait upon the clients' requests before acquiring the document copy, thus compounding the time lapse for centralized and local distribution, only to find that approximately 80% of its acquisitions are not again required by any of its

clients. The problem of storage would have been diminished in its impact but not solved.

An increase in clientele may well increase the quantity of duplicate document requirements within the clientele which makes more attractive the short term solution of locally storing only those documents for which requests have been received. The clientele increase need not necessarily be of the same group which is receiving search service from a regional dissemination center; expansion of the locale of a document clientele, as through a regional network of dissemination centers, would accomplish the proposed increase as long as the particpating centers do not attempt to duplicate storage of documents. Increasing the document requirements of the clientele receiving search service will have a similar effect on multiple requests of documents. The experience of the KASC indicates that structuring of search services may well affect the quantity of document requests submitted by a client. If the ultimate use of information is dependent upon a document, the structuring of search services may also well affect the degree to which the NASA information resources are utilized for nonaerospace applications. Further investigation of the effect of differing search service types upon document utilization should be supported.

Increased utilization of a single document by a clientele becomes mandatory as acquisition costs of documents increase. A decrease in the availability at no cost to its regional dissemination centers of copies of documents within the NASA information resource tends to

destroy the advantage of local document production. The added cost of acquisition increases the cost of locally produced documents. Where the acquisition cost is no less than the price a local client would be required to pay, the sole remaining motivation for use of a local production unit by the client is the convenience of credit.

Based on this discussion, the following recommendations can be made:

- Investigation of means of more rapid distribution of document copy from the central to the local production levels should be conducted as a means of resolving massive storage problems at the local level.
- Efforts to increase clientele usage of documents through optimum search services should be supported.
- Studies should be conducted to determine the optimum size of document clientele, as opposed to search service clientele, for local document production.

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13. ABSTRACT
During a 12 month operational test the KASC provided document service to 73 clients receiving search services who requested a total of 2,891 document copies. In general, the type of search service providing a user with the greatest number of abstracts resulted in the greatest number of document requests; however, users receiving the least number of abstracts tended to request documents for a greater portion of the abstracts which they received. The KASC responded to 2,802 of the above requests during the 12 month period plus 218 requests received just prior to the beginning of the test. The KASC clientele requested approximately 4% to 5% of the documents announced by NASA in STAR during the year with 1.2 requests being submitted per document. Of the requests, 9% were rejected either because the document was not available to the KASC or the cost of the document exceeded that which the client was willing to pay. Of the documents, 80% were produceable by the KASC; however, 16% were obtainable at less cost to the client through the CFSTI. Three per cent of the documents were obtainable only through sources other than NASA or CFSTI. Documents produced locally were provided to KASC clients in one-fourth the time required to obtain them from other sources. Included in the narrative of the report is a description of the search services which the KASC offers to its clientele, the document service system, and the equipment used in production of documents. Clientele search service requirements, their document requirements, and the response of the KASC to these document requirements are presented in detail. Included with the conclusions drawn from the year's experiment are suggestions for additional study pertaining to local document production service for a clientele.